

# **Appendix E**

Tabular summary of Spring 2012 operations and  
cumulative tag detection data

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Data downloaded from CDEC on 6/14/2012 for: OMR, CLC, TRP, and VNS													
2	Experimental period	Date	Day of experimental period	notes	# new tags detected in download on row's date	cumulative # tags detected as of download on row's date	Target ops per stipulation (actual, not as in tech memo)	Vernalis flow from VNS station (cfs)	Old and Middle River flow from OMR CDEC station (cfs)	OMR data flags from CDEC	SWP Clifton Court inflow from CLC CDEC station (cfs)	CVP Tracy inflow from TRP CDEC station (cfs)	combined exports (CLC+TRP)	combined exports (per WOMT table)
3	1st: 4/15-4/30	4/15/2012	1	fish release begin	0	0	-3,500 cfs OMR	3085	-1360		2289	1371	3660	3660
4	1st: 4/15-4/30	4/16/2012	2	fish release end	0	0	-3,500 cfs OMR	3373	-2846		1997	1596	3593	3593
5	1st: 4/15-4/30	4/17/2012	3		0	0	-3,500 cfs OMR	3325	-2719		1989	1044	3033	3033
6	1st: 4/15-4/30	4/18/2012	4		5	5	-3,500 cfs OMR	3091	-2376		2390	812	3202	3202
7	1st: 4/15-4/30	4/19/2012	5	trigger level (9) exceeded	8	13	-3,500 cfs OMR	2792	-2399		2394	813	3207	3194
8	1st: 4/15-4/30	4/20/2012	6		2	15	-3,500 cfs OMR	2682	-2510		1793	1221	3014	2968
9	1st: 4/15-4/30	4/21/2012	7		12	27	-3,500 cfs OMR	2799	-2914		1194	1631	2825	2825
10	1st: 4/15-4/30	4/22/2012	8		3	30	1500 cfs combined exports	2798	-2932		696	1060	1756	1756
11	1st: 4/15-4/30	4/23/2012	9		7	37	1500 cfs combined exports	2739	-2635		696	826	1522	1522
12	1st: 4/15-4/30	4/24/2012	10		5	42	1500 cfs combined exports	2504	-332		695	821	1516	1516
13	1st: 4/15-4/30	4/25/2012	11		2	44	1500 cfs combined exports	2294	-1549		697	822	1519	1519
14	1st: 4/15-4/30	4/26/2012	12		1	45	1500 cfs combined exports	2293	-1774		663	823	1486	1486
15	1st: 4/15-4/30	4/27/2012	13		1	46	1500 cfs combined exports	2353	104		691	819	1510	1510
16	1st: 4/15-4/30	4/28/2012	14		2	48	1500 cfs combined exports	2325	-858		698	816	1514	1514
17	1st: 4/15-4/30	4/29/2012	15		1	49	1500 cfs combined exports	2325	-1584		680	815	1495	1495
18	1st: 4/15-4/30	4/30/2012	16		0	49	1500 cfs combined exports	2399	-1501		686	857	1543	1543
19	2nd: 5/1-5/15	5/1/2012	1	fish release begin	nd	nd	-5,000 cfs OMR	2521	-2468		1342	949	2291	2291
20	2nd: 5/1-5/15	5/2/2012	2	fish release end	3	3	-5,000 cfs OMR	2725	-2898	estimated	1345	976	2321	2321
21	2nd: 5/1-5/15	5/3/2012	3		14	17	-5,000 cfs OMR	2973	-2714	estimated	1495	978	2473	2473
22	2nd: 5/1-5/15	5/4/2012	4	trigger level (24) exceeded	10	27	-5,000 cfs OMR	3103	-3038	estimated	1645	979	2624	2624
23	2nd: 5/1-5/15	5/5/2012	5		14	41	-5,000 cfs OMR	3163	-3030	estimated	1990	983	2973	2973
24	2nd: 5/1-5/15	5/6/2012	6		2	43	-5,000 cfs OMR	3200	-3134		2098	983	3081	3080
25	2nd: 5/1-5/15	5/7/2012	7		2	45	-5,000 cfs OMR	3279	-3251		1943	992	2935	2934
26	2nd: 5/1-5/15	5/8/2012	8		2	47	1500 cfs combined exports	3290	-2987		507	1004	1511	1511
27	2nd: 5/1-5/15	5/9/2012	9		1	48	1500 cfs combined exports	3211	-2229		635	874	1509	1509
28	2nd: 5/1-5/15	5/10/2012	10		0	48	1500 cfs combined exports	3858	-1614		692	816	1508	1507
29	2nd: 5/1-5/15	5/11/2012	11		1	49	1500 cfs combined exports	4289	-1015		697	817	1514	1514
30	2nd: 5/1-5/15	5/12/2012	12		0	49	1500 cfs combined exports	4328	-1293		696	816	1512	1512
31	2nd: 5/1-5/15	5/13/2012	13		0	49	-5,000 cfs OMR	4381	-3164		3299	817	4116	4115
32	2nd: 5/1-5/15	5/14/2012	14		0	49	-5,000 cfs OMR	4418	-3575		1595	2699	4294	4294
33	2nd: 5/1-5/15	5/15/2012	15	fish release begin	2	51	-5,000 cfs OMR	3920	-4149		654	3996	4650	4650
34	3rd: 5/16-5/31	5/16/2012	1	fish release end	0	0	-5,000 cfs OMR	3135	-5204		794	4200	4994	4994
35	3rd: 5/16-5/31	5/17/2012	2		4	4	-5,000 cfs OMR	2750	-5959		793	4201	4994	4993
36	3rd: 5/16-5/31	5/18/2012	3		3	7	-5,000 cfs OMR	2565	-5770		791	4213	5004	5004
37	3rd: 5/16-5/31	5/19/2012	4		12	19	-5,000 cfs OMR	2500	-5072		2194	1791	3985	3985
38	3rd: 5/16-5/31	5/20/2012	5		6	25	-5,000 cfs OMR	2413	-4016		3698	816	4514	4513
39	3rd: 5/16-5/31	5/21/2012	6	trigger level (31) exceeded	9	34	-5,000 cfs OMR	2460	-5096		3699	817	4516	4516
40	3rd: 5/16-5/31	5/22/2012	7		4	38	-5,000 cfs OMR	2413	-5232		3690	817	4507	4507
41	3rd: 5/16-5/31	5/23/2012	8		2	40	-5,000 cfs OMR	2460	-4621		3195	817	4012	4012
42	3rd: 5/16-5/31	5/24/2012	9		1	41	1500 cfs combined exports	2448	-3373		703	818	1521	1521
43	3rd: 5/16-5/31	5/25/2012	10		0	41	1500 cfs combined exports	2254	-2529		699	830	1529	1529
44	3rd: 5/16-5/31	5/26/2012	11		0	41	1500 cfs combined exports	2180	-929		695	814	1509	1509
45	3rd: 5/16-5/31	5/27/2012	12		0	41	1500 cfs combined exports	2408	-1697		692	812	1504	1504
46	3rd: 5/16-5/31	5/28/2012	13		0	41	1500 cfs combined exports	2440	-1747		691	813	1504	1504
47	3rd: 5/16-5/31	5/29/2012	14		1	42	-5,000 cfs OMR	2301	-3580		3491	1359	4850	4850
48	3rd: 5/16-5/31	5/30/2012	15		0	42	-5,000 cfs OMR	2252	-5659		3199	1632	4831	4831
49	3rd: 5/16-5/31	5/31/2012	16		0	42	-5,000 cfs OMR	1865	-5641		2989	1586	4575	4575

	B	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	om CDEC on 6/1	OMR conditions summary				VNS conditions summary				Export conditions summary (combined exports=CLC+TRP)			
2	Date	Average initial OMR	Average OMR during action response	Average OMR after relaxation from action response	Average OMR over whole experimental period	Average initial VNS	Average VNS during action response	Average VNS after relaxation from action response	Average VNS over whole experimental period	Average initial exports	Average exports during action response	Average exports after relaxation from action response	Average exports over whole experimental period
3	4/15/2012												
4	4/16/2012												
5	4/17/2012												
6	4/18/2012	-2446.2857				3021				3219.14286			
7	4/19/2012												
8	4/20/2012												
9	4/21/2012												
10	4/22/2012				-1886.5625				2698.5625				2274.6875
11	4/23/2012												
12	4/24/2012												
13	4/25/2012												
14	4/26/2012		-1451.222222				2447.777778				1540.111111		
15	4/27/2012												
16	4/28/2012												
17	4/29/2012												
18	4/30/2012												
19	5/1/2012												
20	5/2/2012												
21	5/3/2012												
22	5/4/2012	-2933.2857				2994.85714				2671.14286			
23	5/5/2012												
24	5/6/2012												
25	5/7/2012												
26	5/8/2012				-2703.933333				3510.6				2620.8
27	5/9/2012												
28	5/10/2012		-1827.6				3795.2				1510.8		
29	5/11/2012												
30	5/12/2012												
31	5/13/2012												
32	5/14/2012							4239.666667				4353.333333	
33	5/15/2012												
34	5/16/2012												
35	5/17/2012												
36	5/18/2012												
37	5/19/2012												
38	5/20/2012	-5121.25				2587				4565.75			
39	5/21/2012												
40	5/22/2012												
41	5/23/2012				-4132.8125				2427.75				3646.8125
42	5/24/2012												
43	5/25/2012												
44	5/26/2012		-2055				2346				1513.4		
45	5/27/2012												
46	5/28/2012												
47	5/29/2012												
48	5/30/2012							2139.333333				4752	
49	5/31/2012												

# **Appendix F**

NMFS Determination for Operations per Joint  
Stipulation During April 1-7, 2012



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**

NATIONAL MARINE FISHERIES SERVICE  
Southwest Region  
501 West Ocean Boulevard, Suite 4200  
Long Beach, California 90802-4213

**MAR 28 2012**

Mr. Donald R. Glaser  
Regional Director  
Mid-Pacific Region  
U.S. Bureau of Reclamation  
2800 Cottage way, MP-3700  
Sacramento, California 95825-1898

Mr. Mark W. Cowin  
Director  
California Department of Water Resources  
P.O. Box 942836, Room 1115-1  
Sacramento, California 94236-0001

Dear Mr. Glaser and Mr. Cowin:

On January 12, 2012, Plaintiffs, Plaintiff-Intervenor, and Federal Defendants to the Consolidated Salmonid Cases (Case 1:09-cv-01053-LJO –DLB) signed and filed with the Federal court a joint stipulation (Document 659-2) that included Central Valley Project and State Water Project operations for April and May 2012. On March 16, 2012, NMFS transmitted to the U.S. Bureau of Reclamation and the California Department of Water Resources (DWR) the real-time operations technical memorandum required as part of the joint stipulation (Paragraph 2.a.v).

On Monday, March 26, 2012, DWR provided NOAA's National Marine Fisheries Service (NMFS) with Particle Tracking Model simulation results using the Delta Simulation Model 2. This package was distributed to the Delta Operations for Salmonids and Sturgeon (DOSS) working group for discussion at its Tuesday morning meeting (March 26, 2012). DWR also provided additional information to the DOSS through NMFS. The Delta Conditions Team did not meet, and therefore, did not have additional information for DOSS to consider in the development of the DOSS advice.

The enclosure provides DOSS advice to the Water Operations Management Team and NMFS. DOSS advises that (1) an adjustment be made to the rounding process used to specify OMR levels based on modeling information, and (2) based on the adjusted rounding process, that the projects be managed to an OMR level of -1,800 cfs from April 1-7, 2012. The 5-day running average of OMR flow during this period shall be no more than 25% more negative than -1,800 cfs (*i.e.*, -2,250 cfs).



NMFS accepts the DOSS advice, including the adjustment to the rounding process, and determines that the OMR flow of no more negative than -1,800 cfs from April 1-7, 2012, as measured by a 5-day running average that may not be more negative -2,250 cfs, is consistent with the intent and objective of OMR flow management, as provided in the technical memorandum. This OMR flow is within the range of between -1,250 and -3,500 cfs specified by the joint stipulation as the adaptive range for OMR during April 2012. NMFS determines that since the OMR flow for April 1-7, 2012, is consistent with the joint stipulation and associated technical memorandum, that it will avoid jeopardizing the continued existence of Central Valley steelhead.

NMFS appreciates the continued coordination of the parties towards the implementation of the joint stipulation and the technical memorandum.

Sincerely,



for Rodney R. McInnis  
Regional Administrator

Enclosure

## **DOSS Advice for operations from April 1-April 7, 2012**

### **Old and Middle River Flow Management per the 2012 Joint Stipulation, in lieu of Action IV.2.1 of the NMFS Biological Opinion for the Long-Term Operations of the Central Valley Project and State Water Project (NMFS Opinion)**

#### **Summary of Advice from the Delta Operations for Salmonids and Sturgeon (DOSS) group:**

##### **Background:**

DOSS reviewed Particle Tracking Model (PTM) results provided by DWR (Attachment 1). The data from scenarios (A-D), associated with Vernalis flows of 1,500 cfs, were evaluated using the process described in the OMR technical memorandum issued by NMFS on March 16, 2012<sup>1</sup> (OMR Memorandum) to specify the OMR level to be implemented for April 1-April 7, with one minor adjustment described in the advice below.

Note that while Scenario B modeled combined exports of 1,090 cfs [the export level necessary to attain an approximate Old and Middle River (OMR) flow of -1,250 cfs], the OMR Memorandum (page 16) provides that if the specified OMR level "...would require that exports drop below the health and safety export level of 1,500 cfs, the projects shall operate at a combined export level of 1500 cfs."

##### **DOSS advice for Tuesday 3/27/12:**

Adjustment to the rounding process for the specified OMR level:

Advice: The OMR Memorandum (page 17), specified that "...DOSS will...specify OMR rounded to the nearest 250 cfs." DOSS advises that the following rounding process be used instead: "DOSS will specify OMR rounded, in the positive direction, to the nearest 100 cfs."

Rationale: NMFS included a rounding process for OMR specification in the OMR Memorandum in recognition that while the linear interpolation process (as described in Table 2b of the OMR Memorandum) specified a very precise OMR (*e.g.*, the -1,846 cfs on p. 13 of Attachment 1), the PTM approach comparing different operational scenarios to a baseline scenario was not intended to capture hydrodynamic differences at that level of precision. In combination with the flexibility in achieving a target OMR flow (as provided in Table 1 of the OMR Memorandum, that is, no more than 25 percent more negative than the target requirement flow for the 5-day average flow), rounding in the positive direction to the nearest 100 cfs increment provides a reasonable level of precision in capturing modeled differences between operational scenarios. DOSS

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<sup>1</sup> OMR Memorandum available at: [http://swr.nmfs.noaa.gov/ocap/2012\\_stipulation.htm](http://swr.nmfs.noaa.gov/ocap/2012_stipulation.htm)

advised rounding in the positive direction since that is the direction NMFS hypothesizes to provide greater protection for Central Valley steelhead migrating through the Delta.

Advice for OMR level: Per the process described in the OMR Memorandum, as adjusted above, and the data for Scenarios A-D provided by DWR in Attachment 1, DOSS advises that, from April 1 to April 7, 2012, the projects be managed to an OMR level of -1,800 cfs. The 5-day running average of OMR flow during this period shall be no more than 25% more negative than -1,800 cfs (*i.e.*, -2,250 cfs).

Barbara Byrne &lt;barbara.byrne@noaa.gov&gt;

**NMFS PTM Results for April 1-7 OMR Determination**

1 message

Yamanaka, Dan &lt;dany@water.ca.gov&gt;

Mon, Mar 26, 2012 at 10:02 AM

To: "barbara.byrne@noaa.gov" &lt;barbara.byrne@noaa.gov&gt;

Cc: "Wang, Xiaochun" &lt;xwang@water.ca.gov&gt;, "Smith, Tara" &lt;tara@water.ca.gov&gt;, "Zhou, Yu" &lt;yzhou@water.ca.gov&gt;, "Leahigh, John"

&lt;leahigh@water.ca.gov&gt;, "Hinojosa, Tracy" &lt;tracyh@water.ca.gov&gt;, "Pettit, Tracy" &lt;pettit@water.ca.gov&gt;, "Chu, Andy" &lt;andychu@water.ca.gov&gt;

Barb et al,

Attached is our report on the results of the PTM runs performed for NMFS as identified in the "Technical Memorandum to Guide Adaptive Management of OMR during April and May 2012...". The results are to support NMFS' determination of the OMR to be imposed for April 1 through 7 per the Tech Memo and the 2012 Stipulation Agreement.

## Assumptions/Modeling info:

1. 10,000 particles injected over a 24-hour period at both Nodes 40 and 21.
2. Although not required, forecast periods were extended from 28 days to 84 days.
3. Based on our best estimate of April 1 hydrology, San Joaquin flows were assumed to be 1500 cfs.
4. Hydrology was kept static using the estimated April 1 hydrology for the remainder of the forecast period.
5. Due to our inability to precisely predict San Joaquin flows, DWR also performed additional PTM runs with San Joaquin flow at 2500 cfs keeping the rest of the assumptions the same as the 1500 cfs runs.

In addition, the typical DSM2 assumptions consistent with recent modeling efforts were used as follows:

1. CCFB Gates operate on a Priority 3 schedule for the entire forecast period.
2. The Delta Cross Channel gates were closed December 1, 2011.
3. Suisun Marsh salinity control flashboards and boatlock were installed October 21, 2011. Three Suisun Marsh Salinity Control Gates are tied open as of February 14, 2012

4. Sacramento River flow at Freeport is around 43,000 cfs near the beginning of the forecast period and decreases to 14,100 cfs by the end of the forecast period.

The barriers were not installed for scenarios A and E. For scenarios B, C, D, F, G, and H, the following assumptions were made:

1. The Middle River ag. barrier was installed on March 16, 2012 with all culvert flap-gates tied open. The Old River at Tracy ag barrier will be installed on April 1, 2012.
2. The physical head of Old River barrier (including 8 culverts-all tied open) will be installed by April 1, 2012.

If you would like the dss file, please let me know. If you have any questions regarding the results, please contact me at [dany@water.ca.gov](mailto:dany@water.ca.gov) or at (916) 574-0456.

Thanks!

Dan

## Dan Yamanaka

Chief, Delta Compliance & Modeling Section

Operations Control Office

3310 El Camino Avenue, Suite 300

Sacramento, California 95821

[\(916\) 574-0456](tel:(916)574-0456) - Office



**PTM Simulation Results.pdf**

1460K

**PRELIMINARY RESULTS, SUBJECT TO REVISIONS**

# **PTM Simulation Results Using DSM2**

Prepared by:  
Delta Compliance & Modeling Section  
Operations Control Office  
Division of Operations & Maintenance

Prepared for:  
DOSS in regards to the “Technical Memorandum to Guide  
Adaptive Management of OMR during April and May 2012 for the  
Protection of listed San Joaquin Basin Steelhead”

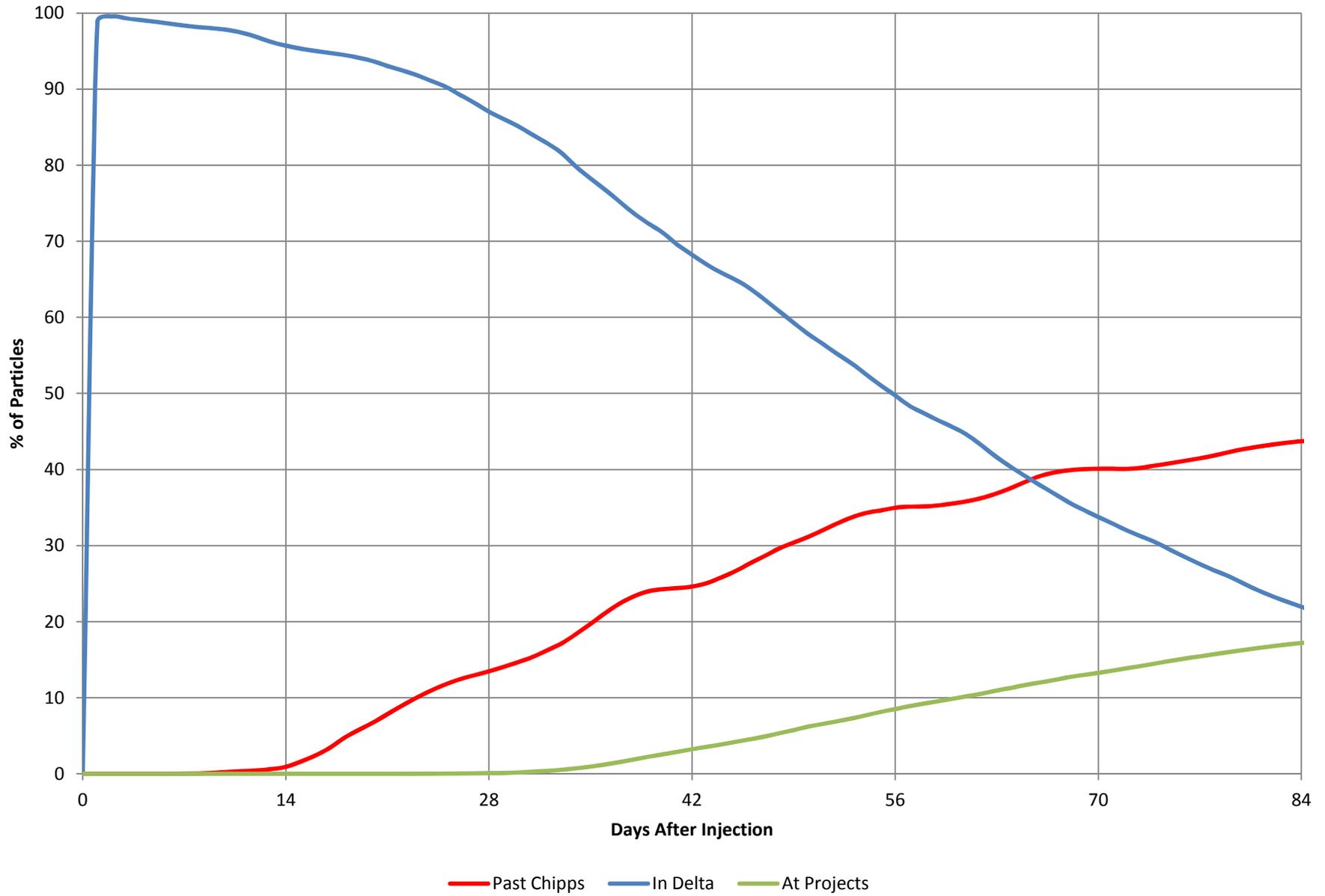
March 26, 2012

## Scenario Summary Table

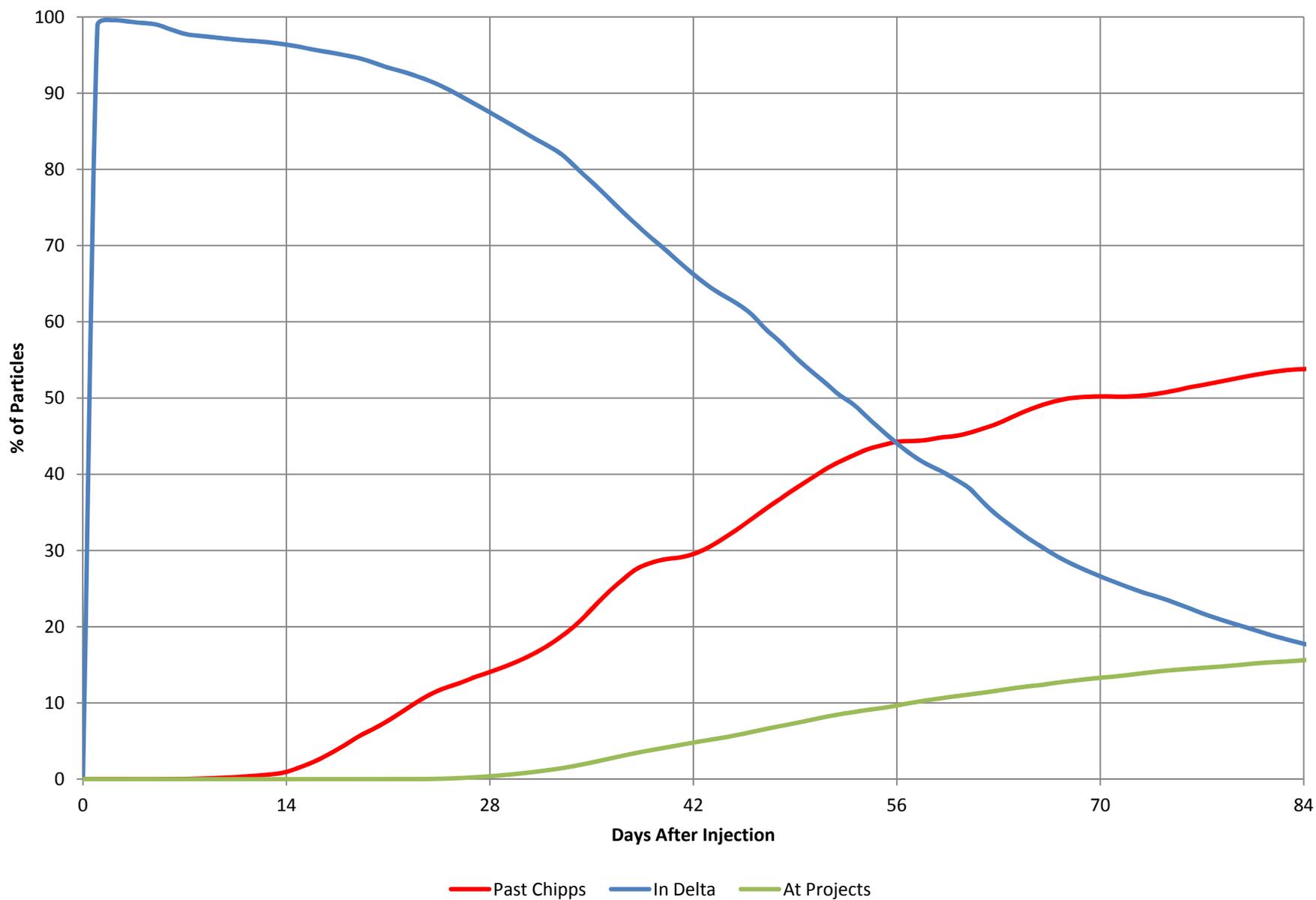
Scenario ID	Control (I:E or OMR)	SJR at Vernalis	Combined Exports	OMR (Index)	OMR (DSM2)	HOR Barrier
A	1 to 1	1500	1500	-976	-1050	Out
B	-1250	1500	1090	-1248	-1147	In
C	-2000	1500	1850	-1963	-1837	In
D	-3500	1500	3450	-3467	-3294	In
E	1 to 1	2500	2500	-1416	-1475	Out
F	-1250	2500	1175	-1249	-1091	In
G	-2000	2500	1950	-1978	-1804	In
H	-3500	2500	3550	-3482	-3263	In

## **Time Series Graphs**

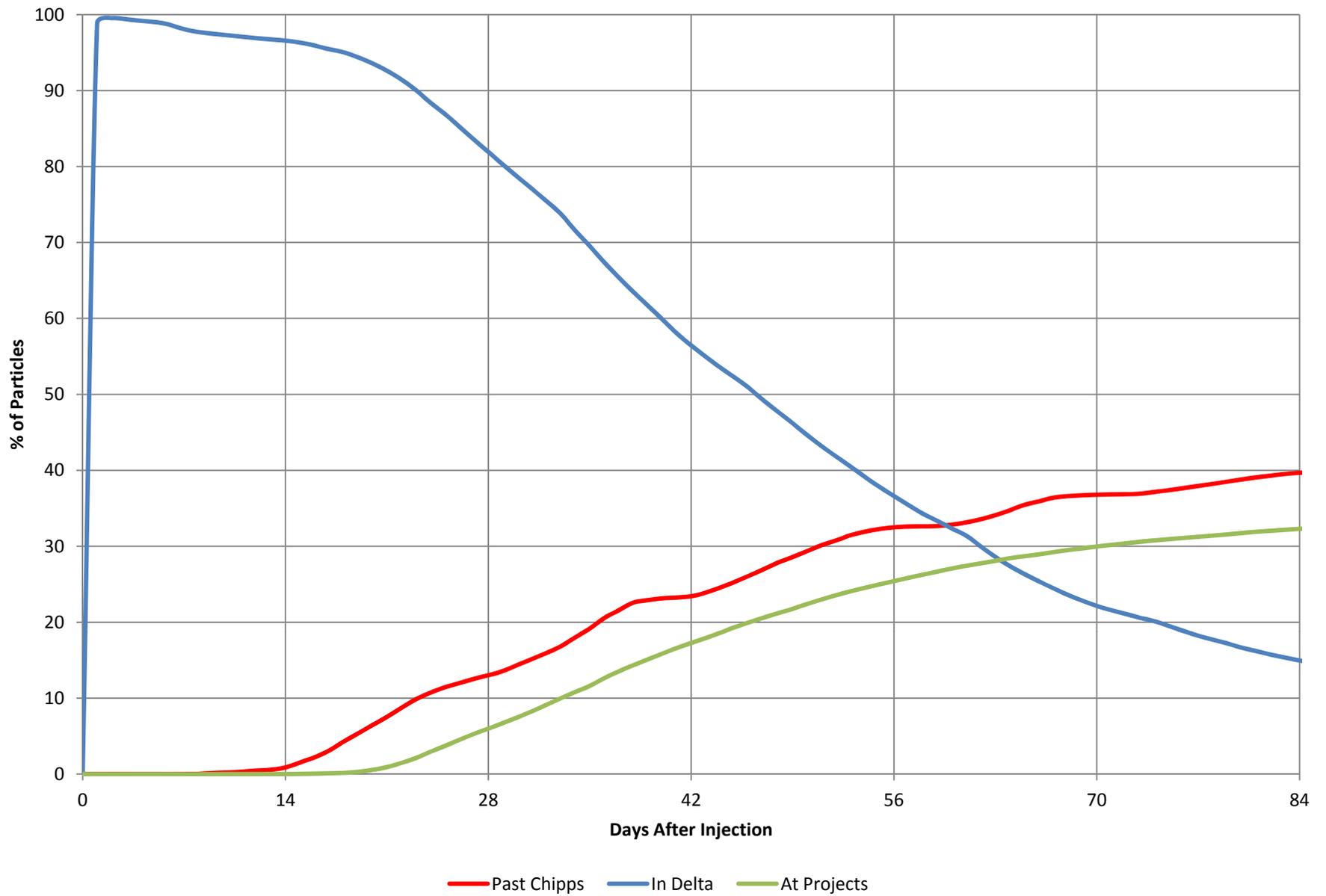
# Scenario A



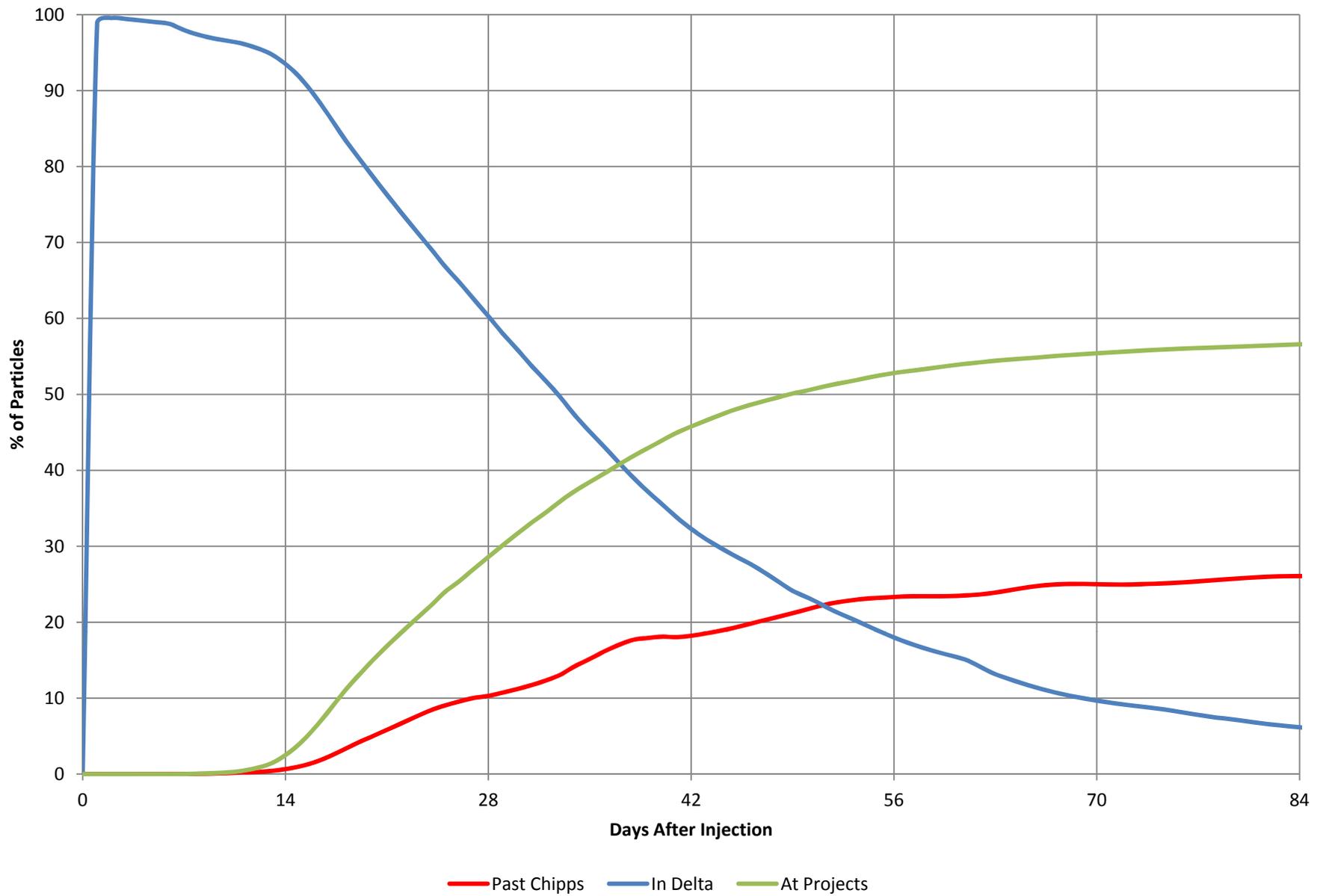
## Scenario B



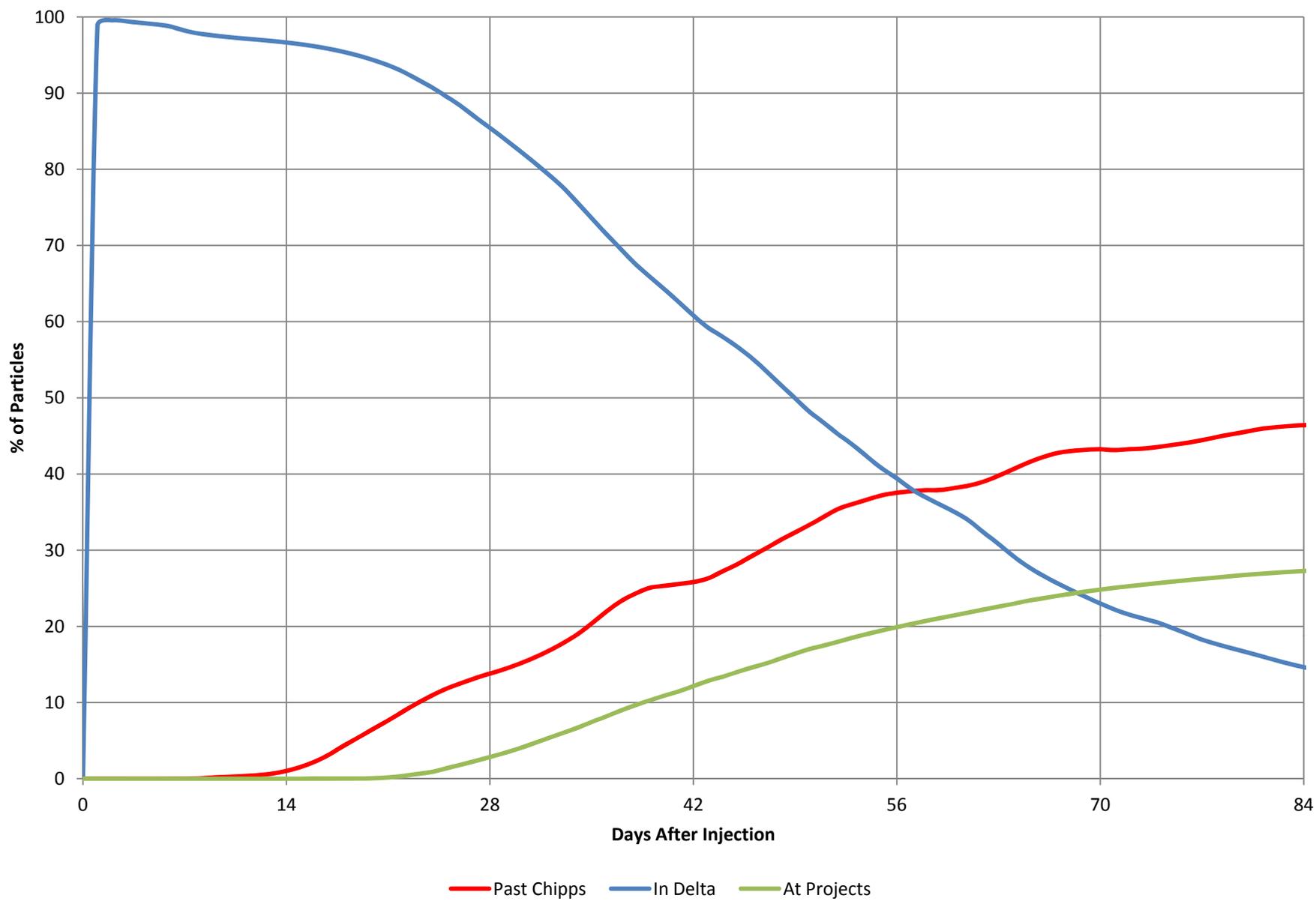
### Scenario C



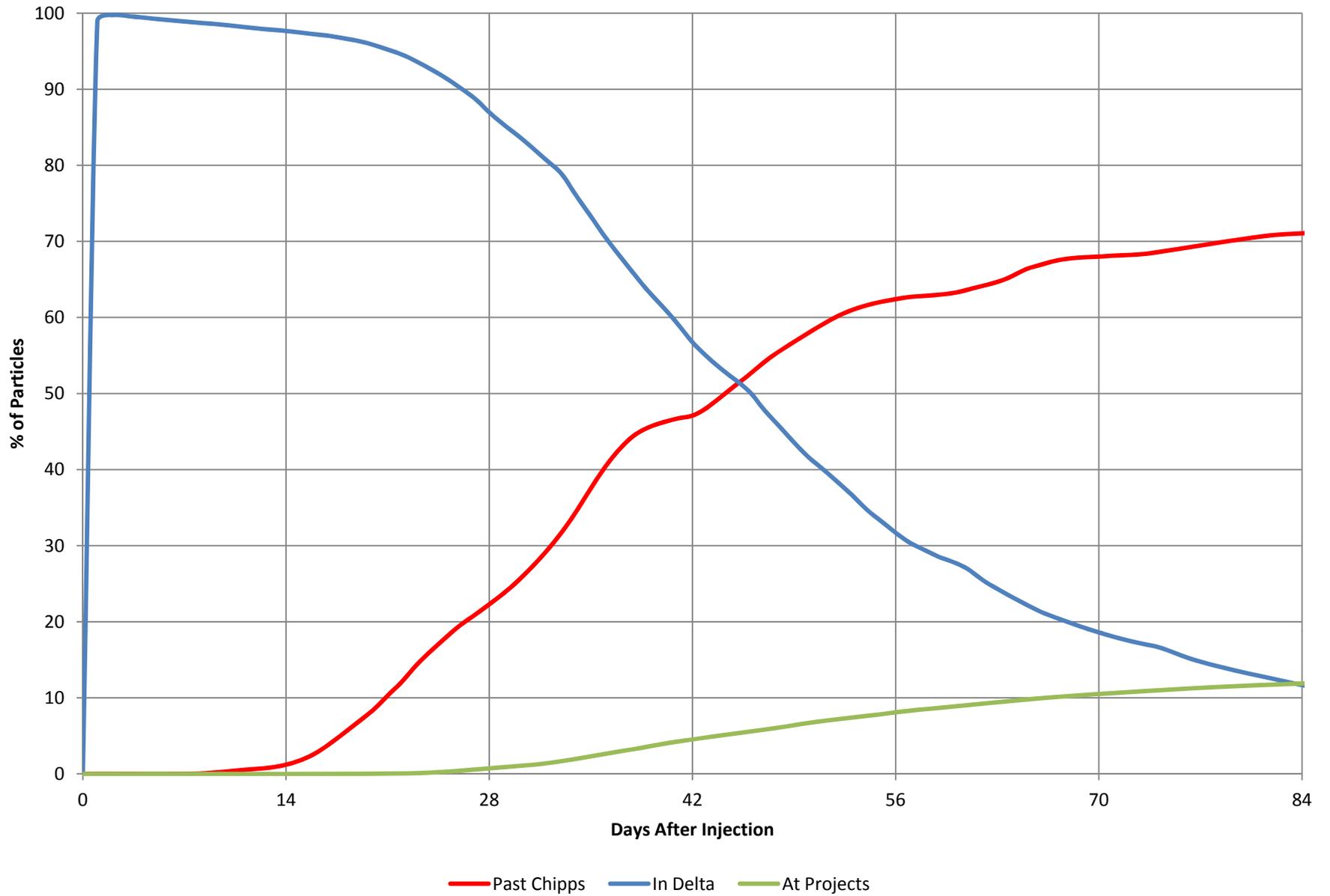
# Scenario D



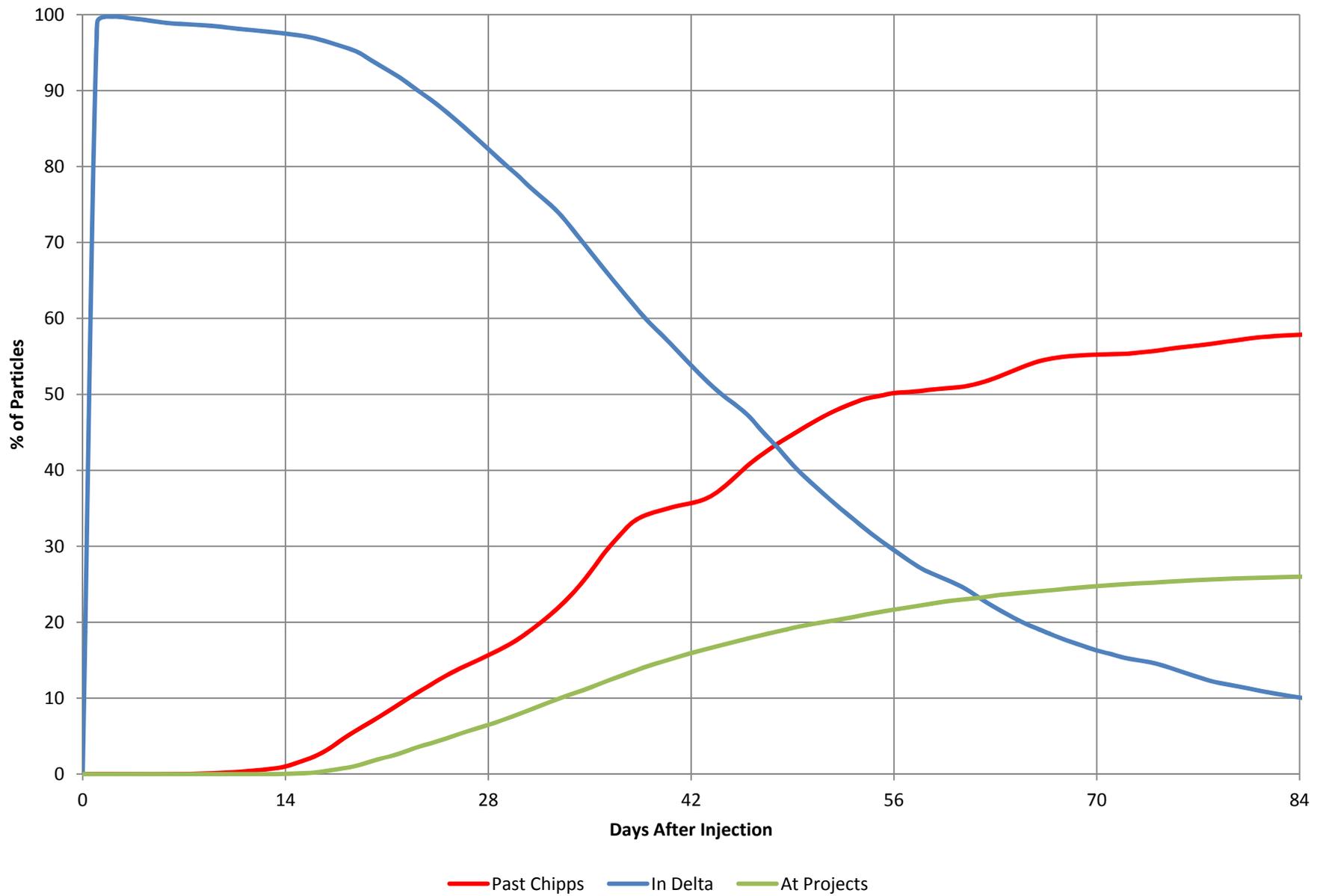
# Scenario E



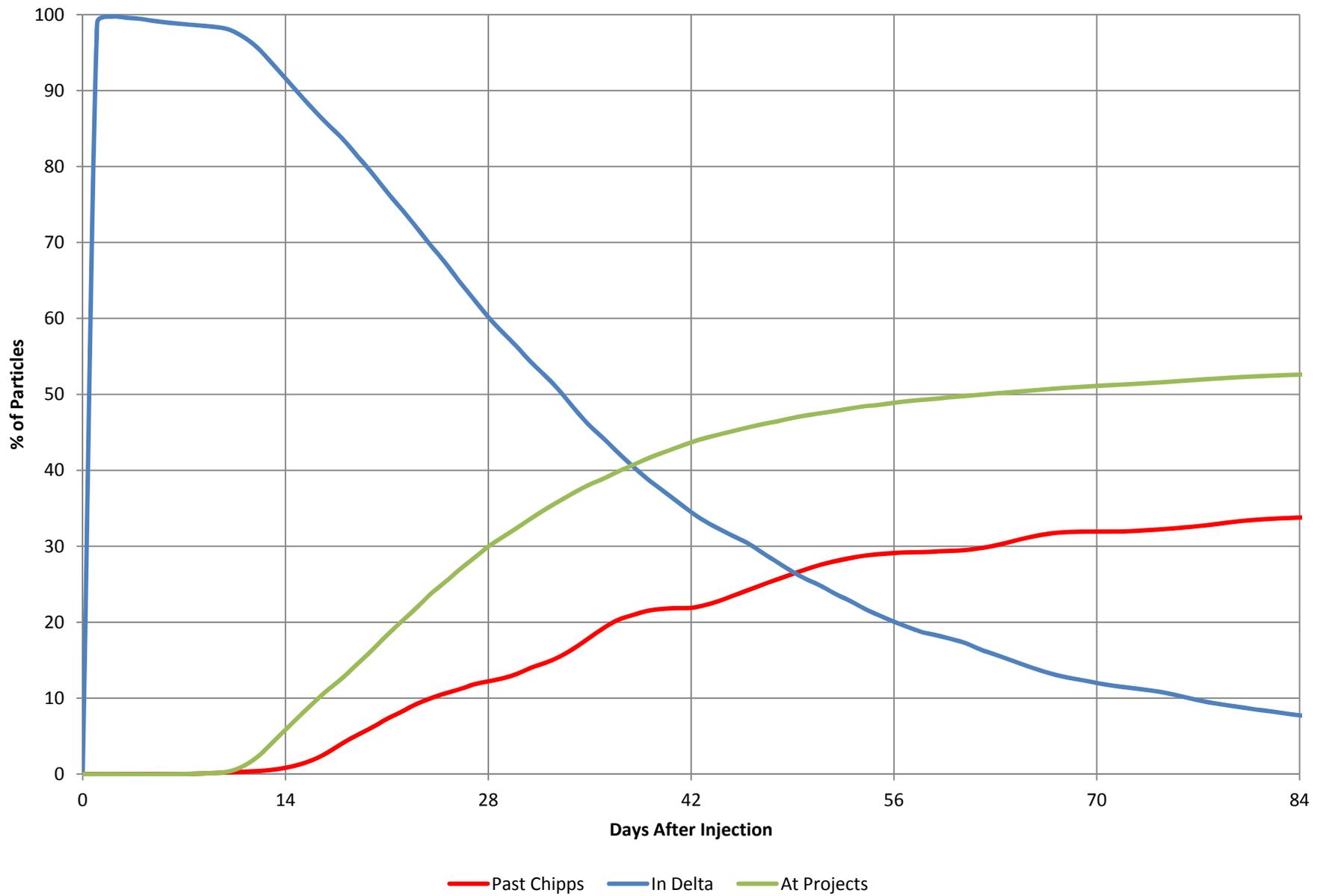
# Scenario F



# Scenario G



# Scenario H

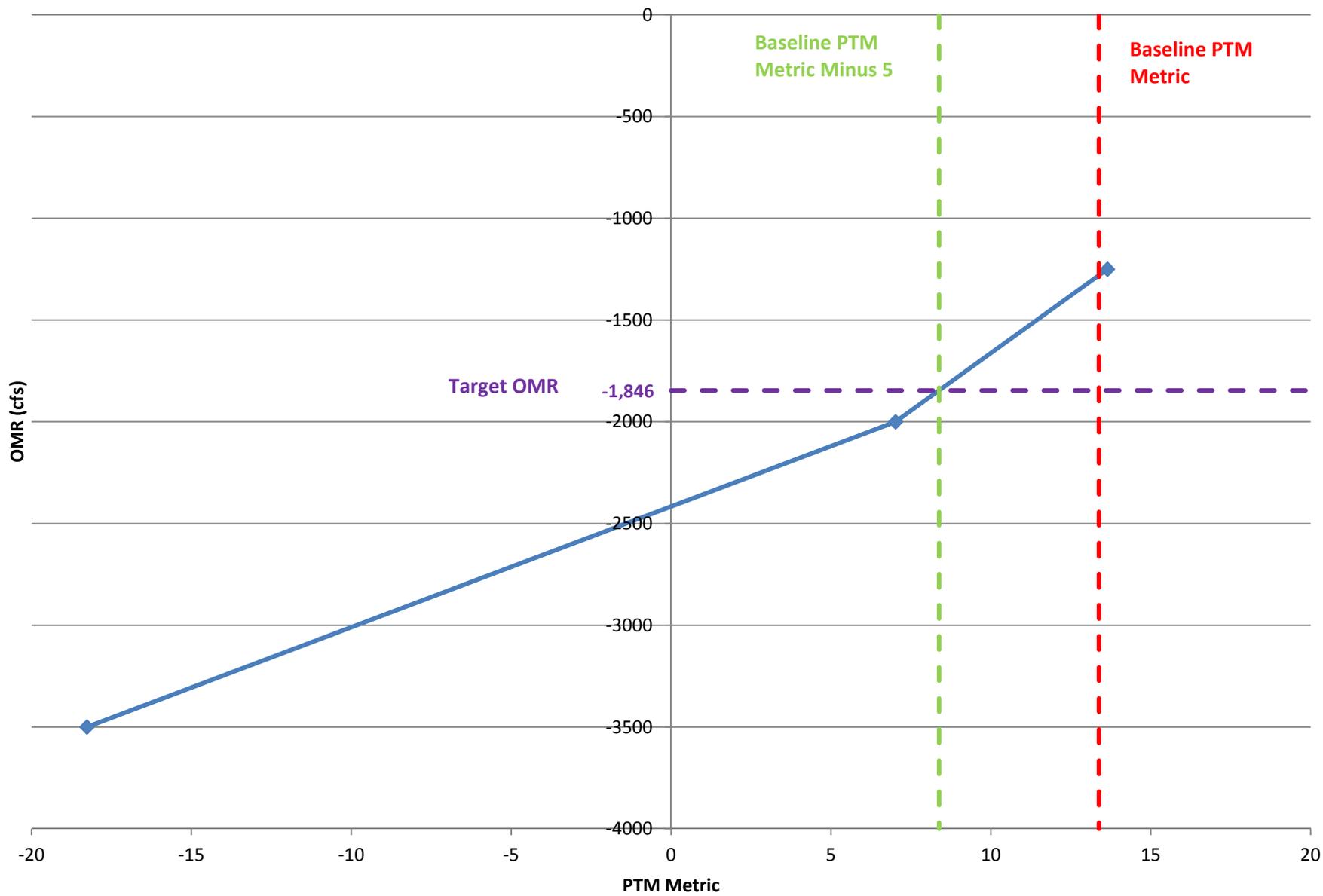


## Result Summary

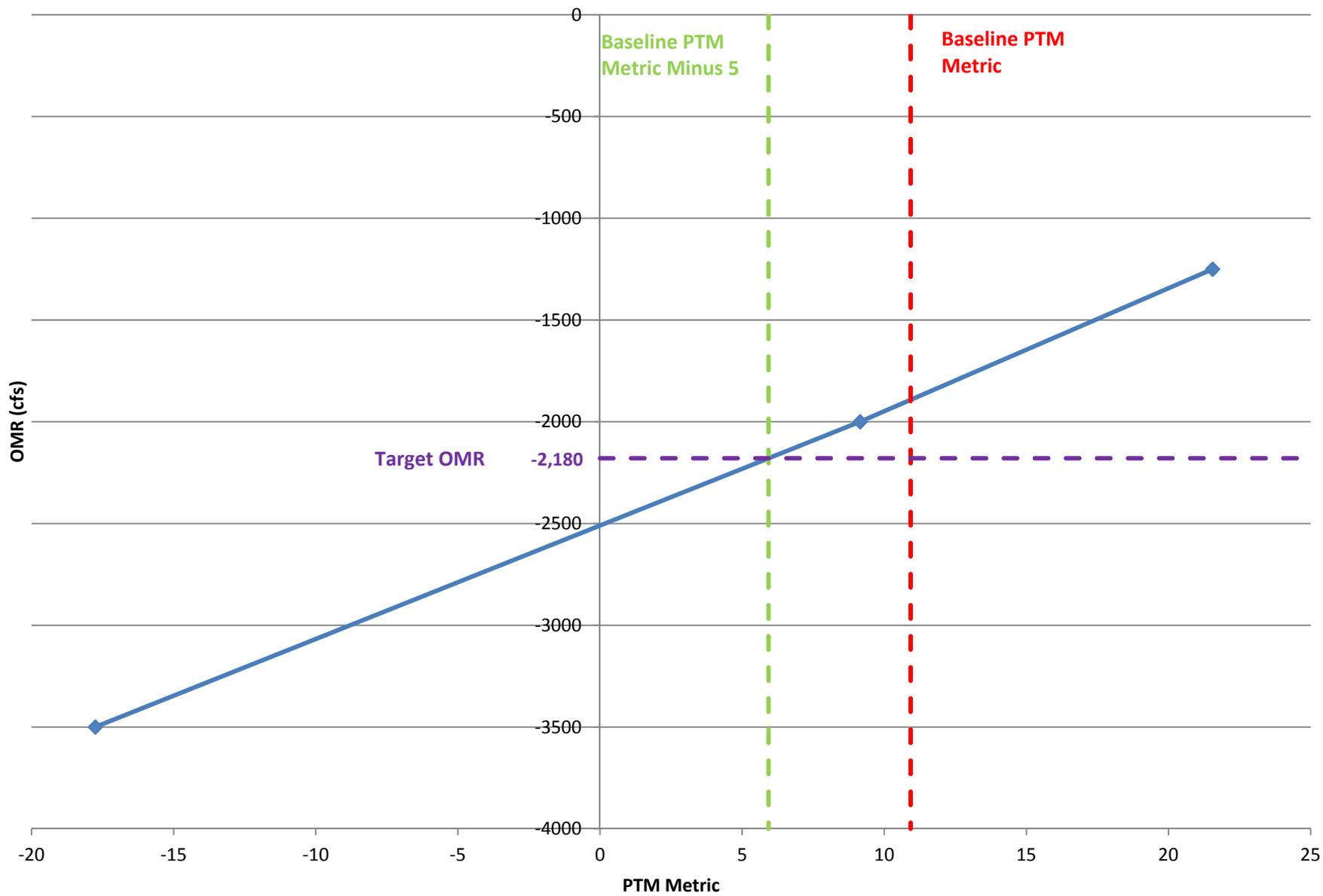
Scenario ID	% past Chipps at 28 days	% to CVP at 28 days	% to SWP at 28 days	PTM metric at 28 days
A	13	0	0	13
B	14	0	0	14
C	13	3	3	7
D	10	13	16	-18
E	14	1	2	11
F	22	1	0	22
G	16	4	3	9
H	12	15	15	-18

PTM metric = % past Chipps at 28 days - % to CVP at 28 days - % to SWP at 28 days

# OMR Flows and PTM Metric with San Joaquin River at 1500 cfs



# OMR Flows and PTM Metric with San Joaquin River at 2500 cfs



# **Appendix G**

NMFS Determination for Operations per Joint  
Stipulation During April 8-14, 2012



**UNITED STATES DEPARTMENT OF COMMERCE**  
**National Oceanic and Atmospheric Administration**  
NATIONAL MARINE FISHERIES SERVICE  
Southwest Region  
501 West Ocean Boulevard, Suite 4200  
Long Beach, California 90802-4213

APR 4 2012

Mr. Don Glaser  
Regional Director  
Mid-Pacific Region  
U.S. Bureau of Reclamation  
2800 Cottage Way, MP-3700  
Sacramento, California 95825-1898

Mr. Mark Cowin  
Director  
California Department of Water Resources  
P.O. Box 942836, Room 1115-1  
Sacramento, California 94236-0001

Dear Mr. Glaser and Mr. Cowin:

On January 12, 2012, Plaintiffs, Plaintiff-Intervenor, and Federal Defendants to the Consolidated Salmonid Cases (Case 1:09-cv-01053-LJO –DLB) signed and filed with the Federal court a joint stipulation (Document 659-2) that included Central Valley Project and State Water Project operations for April and May 2012. On March 16, 2012, NMFS transmitted to the U.S. Bureau of Reclamation and the California Department of Water Resources (DWR) the real-time operations technical memorandum required as part of the joint stipulation (Paragraph 2.a.v).

On Monday, April 2, 2012, DWR provided NOAA's National Marine Fisheries Service (NMFS) with Particle Tracking Model simulation results using the Delta Simulation Model 2. This information was distributed to the Delta Operations for Salmonids and Sturgeon (DOSS) working group for discussion at its Tuesday morning meeting (April 3, 2012). The Delta Conditions Team met on Monday, April 2, 2012, but did not provide additional information for DOSS to consider in the development of the DOSS advice.

The enclosure provides DOSS advice to the Water Operations Management Team and NMFS. DOSS advises that (1) an amendment be made to the calculation of the PTM screening criterion used to specify OMR levels based on modeling information, and (2) based on the amended PTM screening criterion calculation, that the projects be managed to an OMR level of -2,500 cfs from April 8-14, 2012. The 5-day running average of OMR flow during this period shall be no more than 25% more negative than -2,500 cfs (*i.e.*, -3,125 cfs).

NMFS accepts the DOSS advice, including the amendment to the calculation of the PTM screening criterion, and determines that the OMR flow of no more negative than -2,500 cfs from April 8-14, 2012, as measured by a 5-day running average that may not be more negative than



-3,125 cfs, is consistent with the intent and objective of OMR flow management, as provided in the technical memorandum. This OMR flow is within the range of between -1,250 and -3,500 cfs specified by the joint stipulation as the adaptive range for OMR during April 2012. NMFS determines that since the OMR flow for April 8-14, 2012, is consistent with the joint stipulation and associated technical memorandum, that it will avoid jeopardizing the continued existence of Central Valley steelhead.

NMFS notes that the 700 cfs change in the OMR flow limit for the April 8 through 14<sup>th</sup> period (-2,500 cfs) as compared to the OMR target for the April 1<sup>st</sup> through 7<sup>th</sup> period (-1,800 cfs) is largely due to changes in forecasted hydrology, for example, the increase in flows that are projected at Vernalis during the second week of April due to implementation of the Stanislaus River flow schedule under the NMFS biological opinion.

The technical memorandum provides flexibility in adjusting the order of the prescribed two-week OMR experimental treatment levels (“DOSS may adjust the ordering of OMR flow management targets opportunistically during April and May 2012,” page 8 of the technical memorandum). The DOSS and the Water Operations Management Team considered and discussed adjusting the order of the OMR treatment levels in May, currently -1,250 cfs from May 1-14 and -5,000 cfs from May 15-31. However, there are many variables to consider (*e.g.*, water year type for the San Joaquin basin, delta smelt distribution and risk of entrainment, forecasted flows at Vernalis) before a change in the order of the OMR treatment is proposed. DOSS and WOMT will continue discussing the potential adjustment in the coming weeks.

NMFS appreciates the continued coordination of the parties towards the implementation of the joint stipulation and the technical memorandum.

Sincerely,



Rodney R. McInnis  
Regional Administrator

Enclosure

## **DOSS Advice for operations from April 8-April 14, 2012**

### **Old and Middle River Flow Management per the 2012 Joint Stipulation, in lieu of Action IV.2.1 of the NMFS Biological Opinion for the Long-Term Operations of the Central Valley Project and State Water Project (NMFS Opinion)**

#### **Summary of Advice from the Delta Operations for Salmonids and Sturgeon (DOSS) group:**

##### **Background:**

DOSS reviewed Particle Tracking Model (PTM) results provided by DWR on April 2, 2012 (Attachment 1). The data from scenarios (A-D), associated with predicted Vernalis flows of 2,500 cfs for the week of April 8 - 14, 2012, were evaluated using the process described in the OMR technical memorandum issued by NMFS on March 16, 2012<sup>1</sup> (OMR Memorandum) to specify the OMR level to be implemented for April 8-April 14, with an adjustment to the calculation of the PTM screening criterion described in the advice below.

##### **DOSS advice for Tuesday 4/3/12:**

Adjustment to the simulation period used to calculate the PTM screening criterion:

Advice: The OMR Memorandum (pages 6-8) describes the calculation of the PTM screening criterion as based on particle fates measured 28 days after particle insertion, but notes (footnote 3 on page 6) that "...under forecasted hydrology, the fates of a significant number of particles may not be resolved within 28 days. If DWR submits PTM information based on a simulation period longer than 28 days, DOSS will consider that information and may advise that the PTM screening criterion be amended." DOSS advises that the calculation of the PTM screening criterion be amended such that, for each scenario, the fraction of particles exiting the Delta system past Chipps Island, at the SWP, and at the CVP, be measured after a simulation period within which at least 50% of particles have been resolved in all scenarios. This simulation period will be determined as the number of days in which 50% of inserted particles have reached some fate in the scenario (either the baseline scenario or any of the three operational scenarios) with the slowest dynamics.

The PTM results submitted on April 2, 2012 (page 15 of Attachment 1) show that 50% of inserted particles were resolved at 55 days in Scenario A (compared to 50, 49, and 38 days in Scenarios B, C, and D, respectively). DOSS thus advises that the PTM screening criterion for these scenarios be calculated based on particle fates measured at 55 days.

Rationale: NMFS intends the PTM screening criterion to be an aggregate measure of different flow conditions under different operations scenarios. As noted in the OMR Memorandum (p. 6), "Because NMFS is using PTM to provide a representation of how

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<sup>1</sup> OMR Memorandum available at: [http://swr.nmfs.noaa.gov/ocap/2012\\_stipulation.htm](http://swr.nmfs.noaa.gov/ocap/2012_stipulation.htm)

the distribution of particles is affected by different hydrodynamics condition (*sic*), the simulation window must be long enough for particle fates to be resolved.” The blue “In Delta” line on the time series graphs in Attachment 1 (pages 5-8) represents the fraction of particles that have not yet reached one of the five “standard” PTM fates (CVP, SWP, agricultural diversion, Contra Costa diversion, past Martinez). In all but Scenario D, less than 20% of the inserted particles have reached a fate by Day 28 of the simulation. This pattern was also present in the PTM data reviewed by DOSS on March 27, 2012. DOSS discussed possible refinements to the calculation method for the PTM screening criterion at that time but deferred the decision to the April 3, 2012, DOSS call to allow DOSS members sufficient time to consider the proposed refinements.

Based on preliminary discussion on the March 27, 2012, DOSS call, and further discussion on the April 3, 2012, DOSS call, DOSS agreed to amend the calculation of the PTM screening criterion as described in the Advice above. Measuring the fraction of particles reaching some fate on the same day for all scenarios allows the PTM screening criteria to capture differences in the timing dynamics between scenarios. Measuring the fraction of particles reaching some fate on the day on which 50% of particles have reached a fate in the slowest scenario means that scenarios will be compared based on results from *at least* 50% of particles. This approach thus captures timing dynamic differences and makes comparisons based on a substantive (at least 50%) fraction of inserted particles.

Advice for OMR level: Per the process described in the OMR Memorandum, the adjusted calculation for the PTM screening criterion advised above, the adjusted rounding process as advised last week, and the data for Scenarios A-D provided by DWR in Attachment 1, DOSS advises that, from April 8 to April 14, 2012, the projects be managed to an OMR level of -2,500 cfs. The 5-day running average of OMR flow during this period shall be no more than 25% more negative than -2,500 cfs (*i.e.*, -3,125 cfs).

# **ATTACHMENT 1**

PTM data provided by DWR to DOSS on April 2, 2012

Barbara Byrne &lt;barbara.byrne@noaa.gov&gt;

**NMFS PTM Results for April 8-14 OMR Determination**

1 message

Yamanaka, Dan &lt;dany@water.ca.gov&gt;

Mon, Apr 2, 2012 at 12:26 PM

To: Barbara Byrne &lt;barbara.byrne@noaa.gov&gt;, "Ford, John M (Mike)" &lt;jmford@water.ca.gov&gt;

Cc: "Leahigh, John" &lt;leahigh@water.ca.gov&gt;, "Hinojosa, Tracy" &lt;tracyh@water.ca.gov&gt;, "Pettit, Tracy" &lt;pettit@water.ca.gov&gt;, "EKiteck@usbr.gov" &lt;EKiteck@usbr.gov&gt;, "Washburn, Thuy T" &lt;TWashburn@usbr.gov&gt;

Barb, Mike,

Attached is our report of the PTM results performed for NMFS per the "Technical Memorandum to Guide Adaptive Management of OMR during April and May 2012...". The results are to support NMFS' determination of the OMR to be imposed for April 8 through 14.

Modeling info:

1. 10,000 particles injected over a 24-hour period at both Nodes 40 and 21.
2. Although not required, forecast period was extended from 28 days to 84 days.
3. Based on our best estimate of April 8 hydrology, San Joaquin flows were assumed to be 2500 cfs.
4. Delta hydrology was kept static using the estimated April 8 hydrology for the remainder of the forecast period.

In addition, the typical DSM2 assumptions consistent with recent modeling efforts were used as follows:

1. CCFB Gates operate on a Priority 3 schedule for the entire forecast period.
2. The Delta Cross Channel gates were closed December 1, 2011.
3. Suisun Marsh salinity control flashboards and boatlock were installed October 21, 2011. Three Suisun Marsh Salinity Control Gates are tied open as of February 14, 2012
4. Sacramento River flow at Freeport is around 15,000 cfs near the beginning of the forecast period and decreases to 11,100 cfs by the end of the forecast period.

The barriers were not installed for scenario A. For scenarios B, C, and D, the following assumptions were made:

1. The Middle River ag. barrier was installed on March 16, 2012 with all culvert flap-gates tied open. The Old River at Tracy ag barrier was installed on April 1, 2012.
2. The physical Head of Old River Barrier (including 8 culverts-all tied open) was installed on April 1, 2012.

If you would like the dss file, please let me know. If you have any questions regarding the results, please contact me at [dany@water.ca.gov](mailto:dany@water.ca.gov) or at (916) 574-0456.

Thanks!

Dan

## Dan Yamanaka

Chief, Delta Compliance & Modeling Section

Operations Control Office

3310 El Camino Avenue, Suite 300

Sacramento, California 95821

[\(916\) 574-0456](tel:9165740456) - Office

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 **PTM\_Week\_2.pdf**  
297K

**PRELIMINARY RESULTS, SUBJECT TO REVISIONS**

# **PTM Simulation Results Using DSM2**

Prepared by:  
Delta Compliance & Modeling Section  
Operations Control Office  
Division of Operations & Maintenance

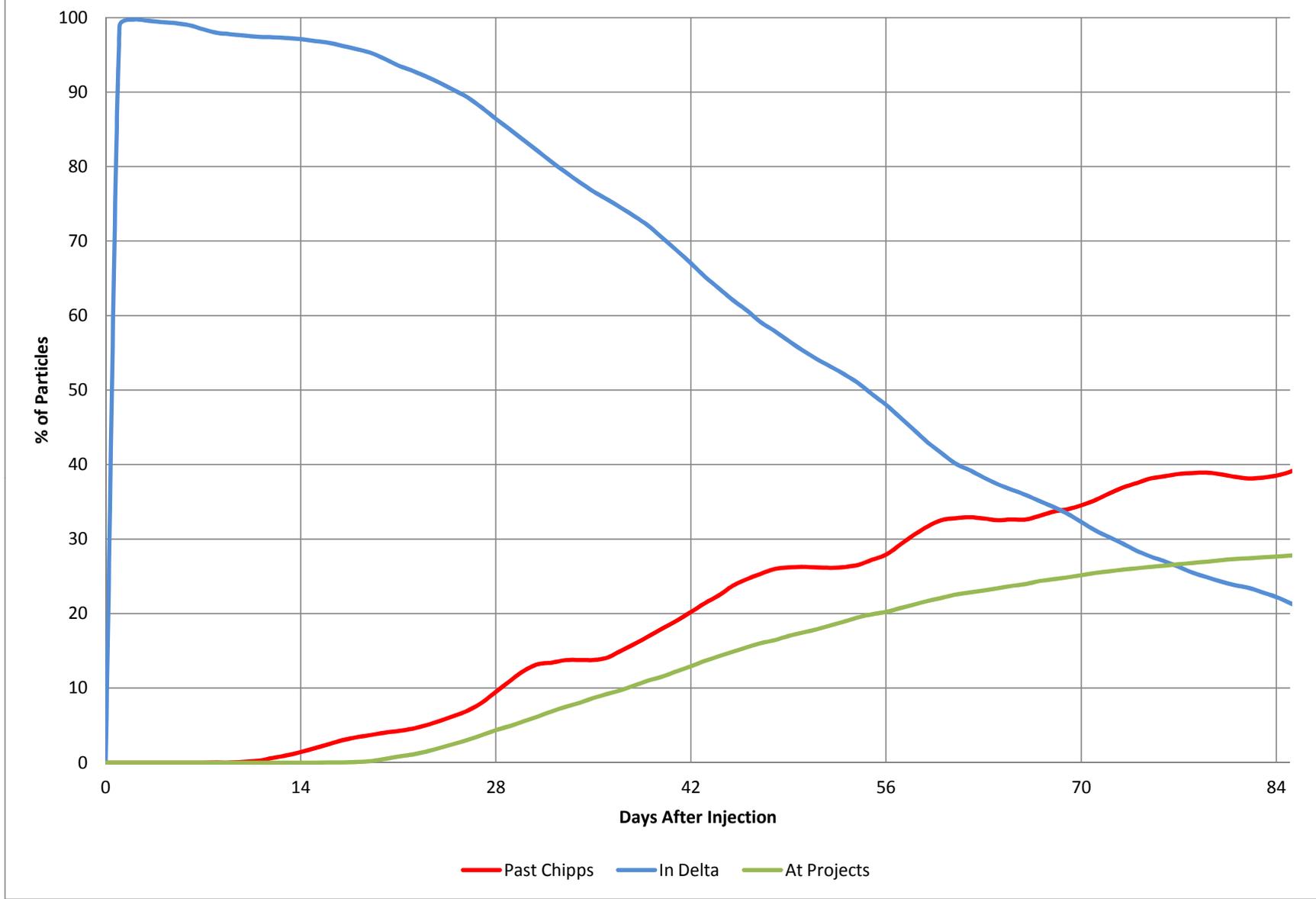
Prepared for:  
DOSS in regards to the “Technical Memorandum to Guide  
Adaptive Management of OMR during April and May 2012 for the  
Protection of listed San Joaquin Basin Steelhead”

March 30, 2012

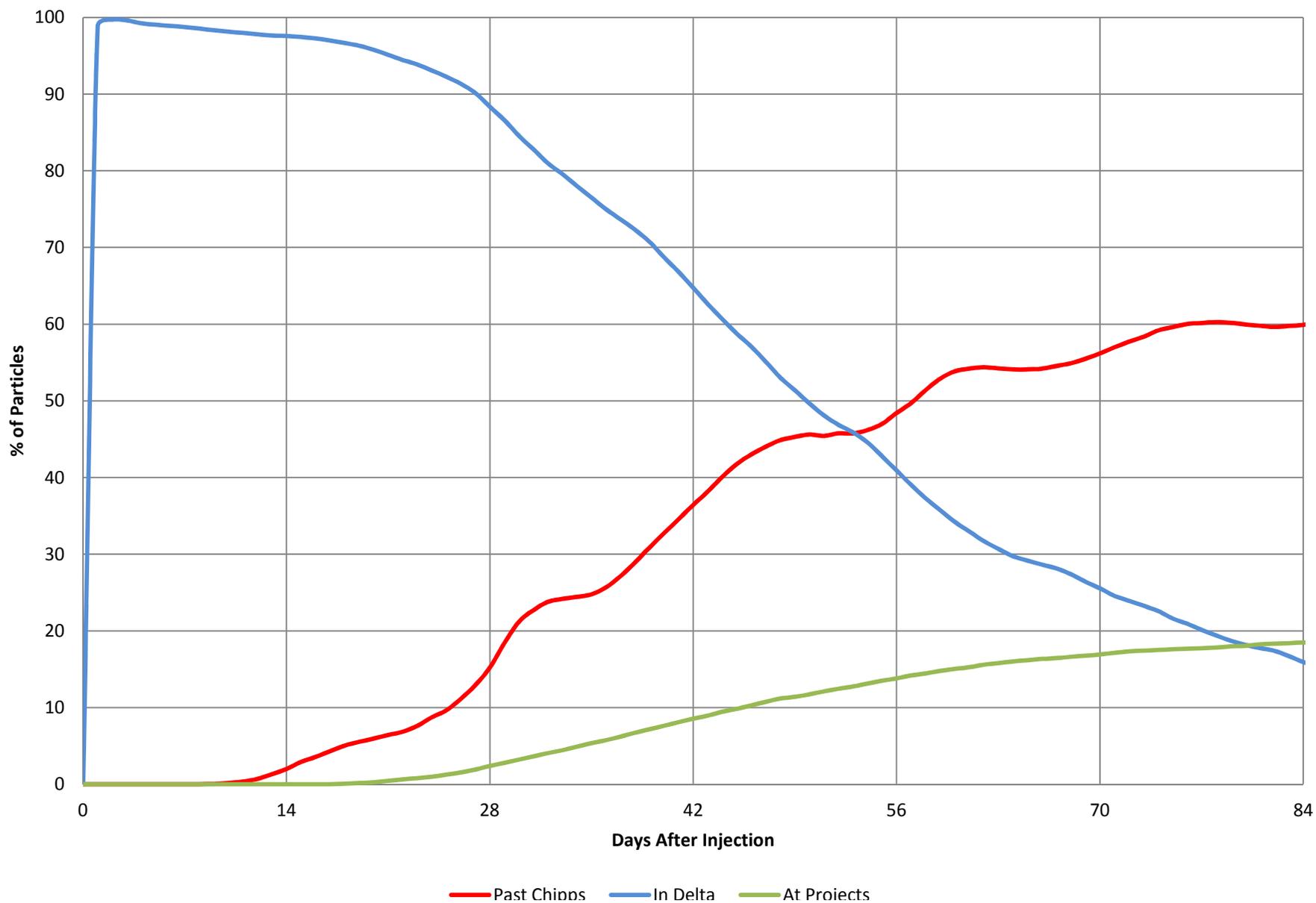
Scenario Summary Table

Scenario ID	Control	SJR at Vernalis	Combined Exports	OMR (Index)	OMR (DSM2)	HOR Barrier
A	1 to 1	2500	2500	-1438	-1588	Out
B	Min Exports	2500	1500	-1591	-1434	In
C	-2000	2500	1900	-1954	-1800	In
D	-3500	2500	3450	-3457	-3257	In

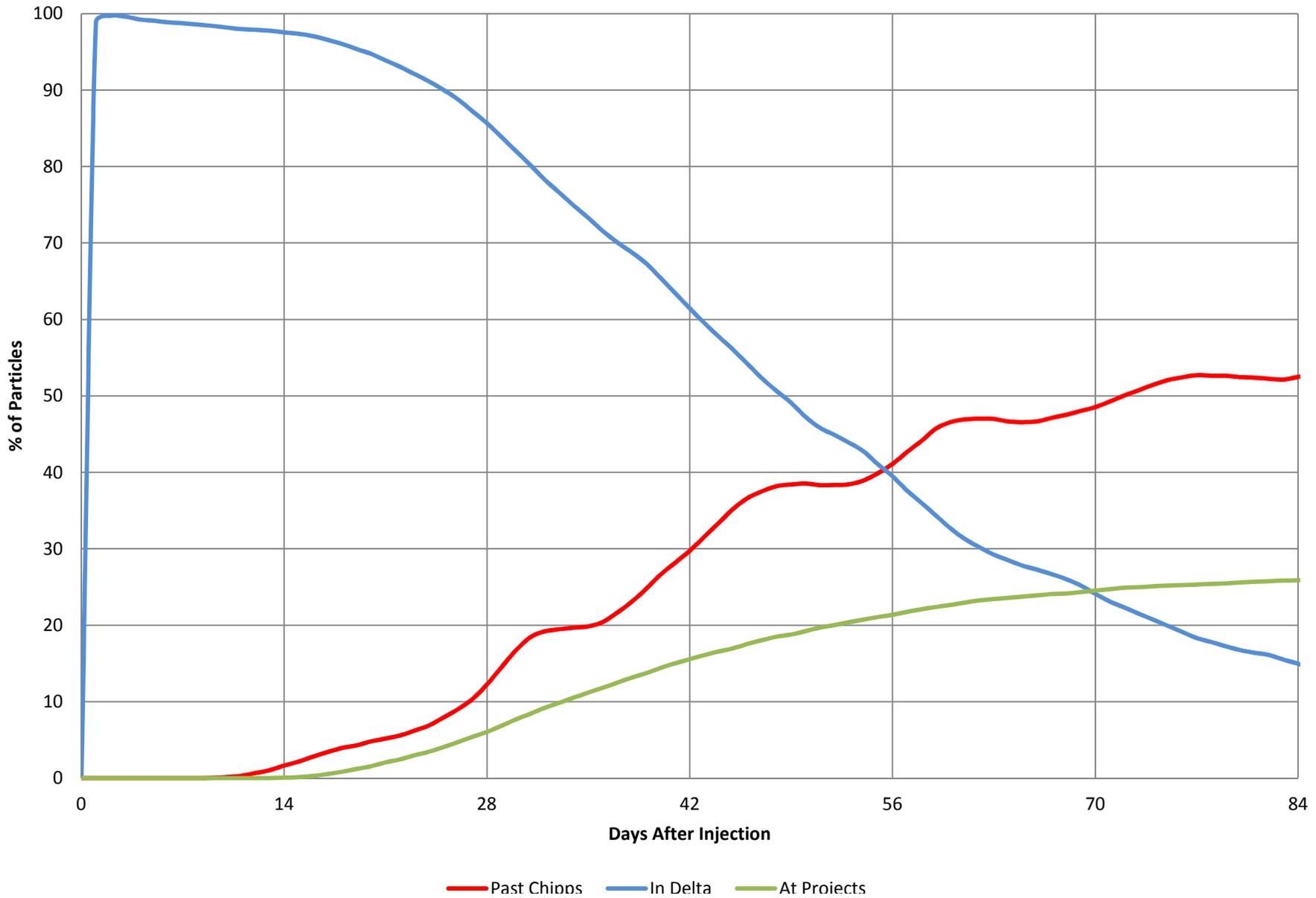
### Scenario A - Vernalis 1 to 1



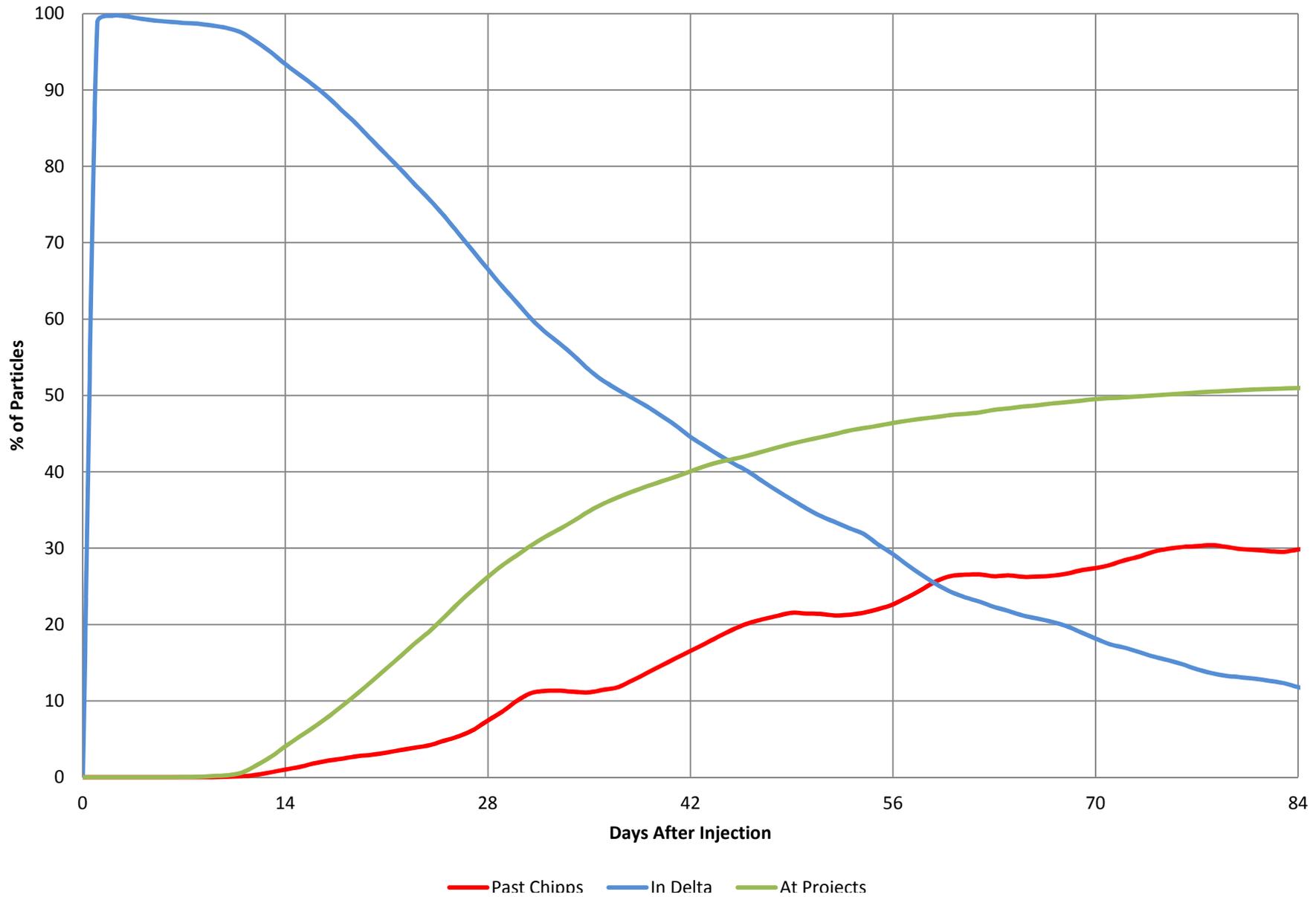
### Scenario B - Combined 1500 cfs Exports



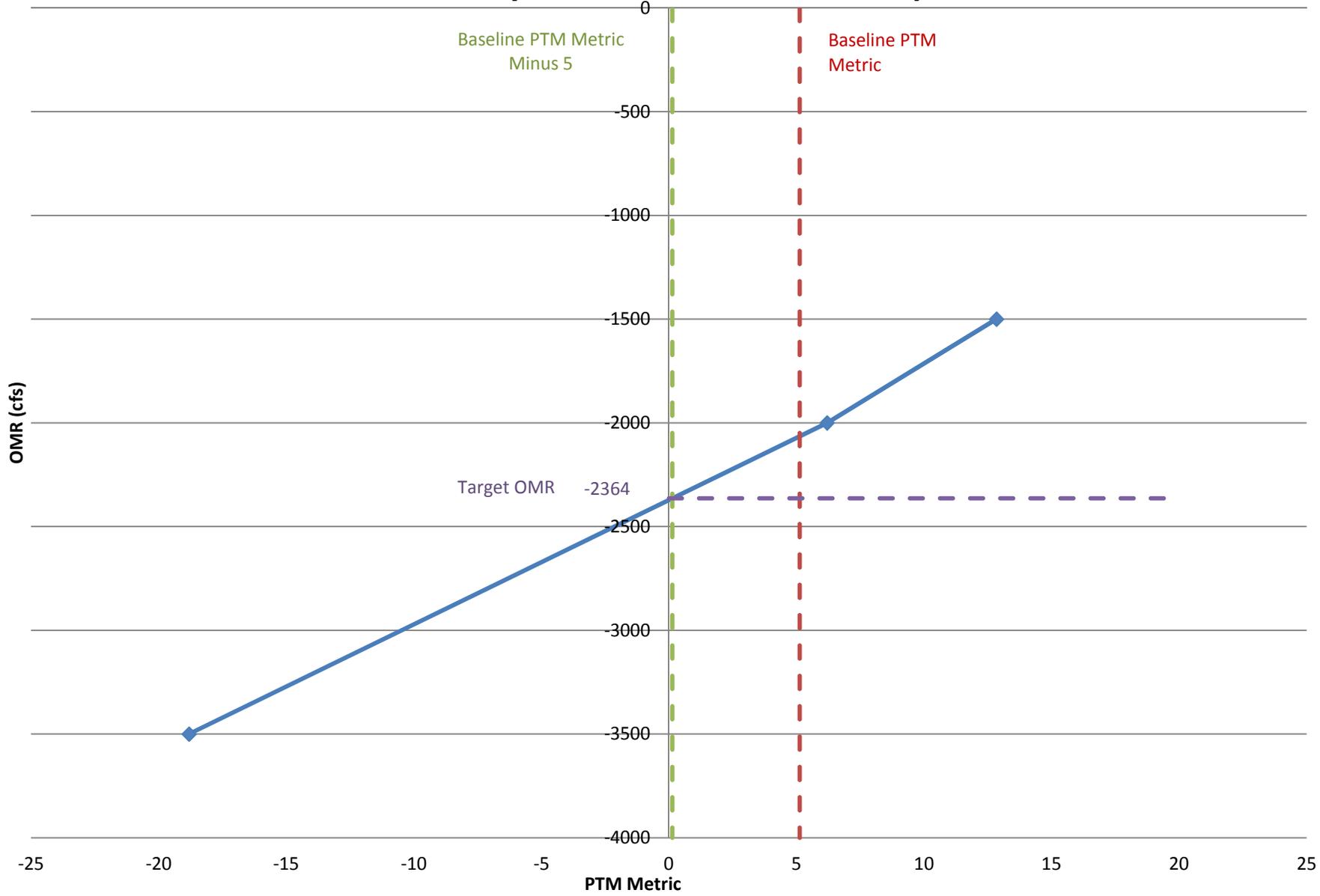
### Scenario C - OMR -2000 cfs



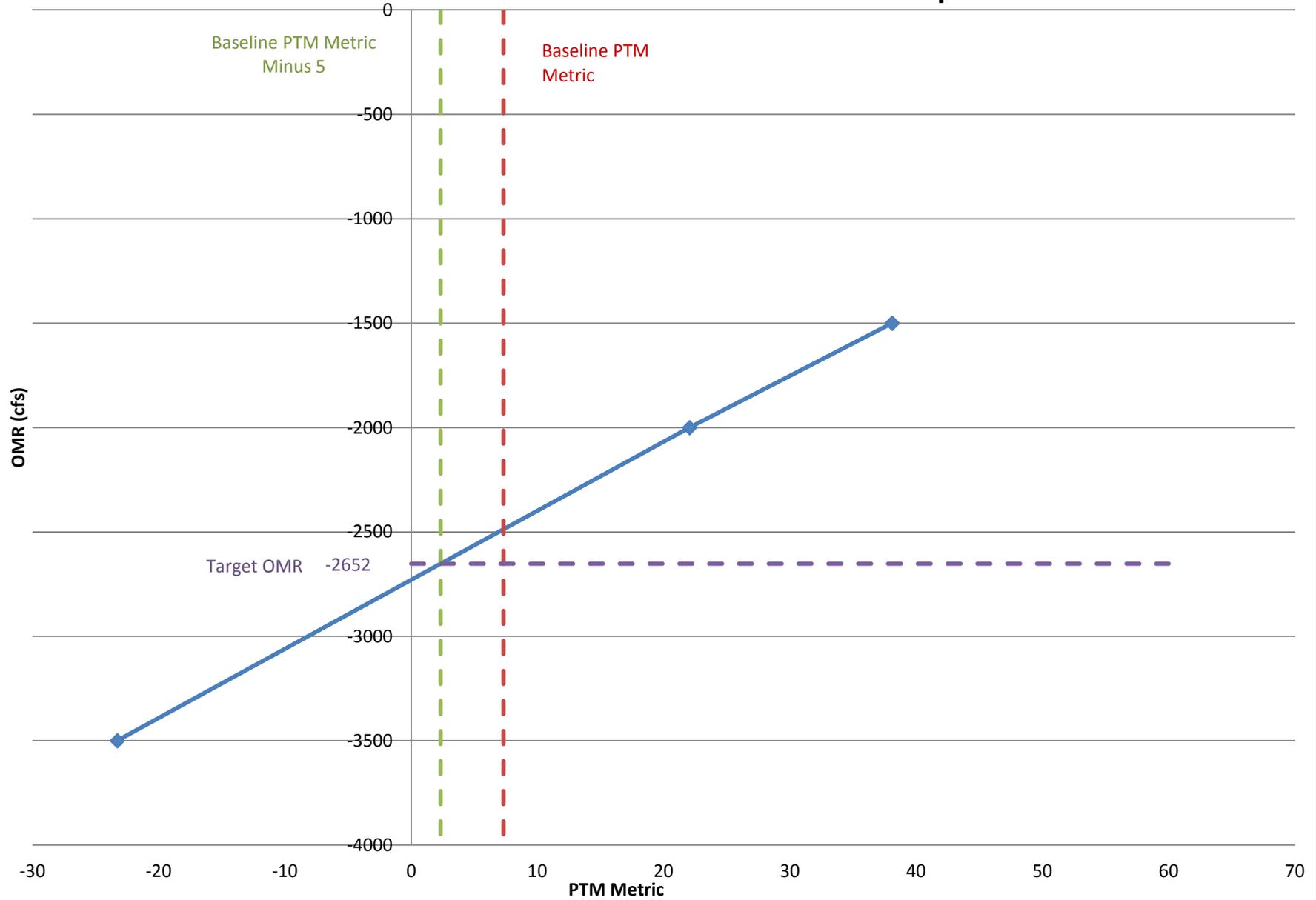
### Scenario D - OMR -3500 cfs



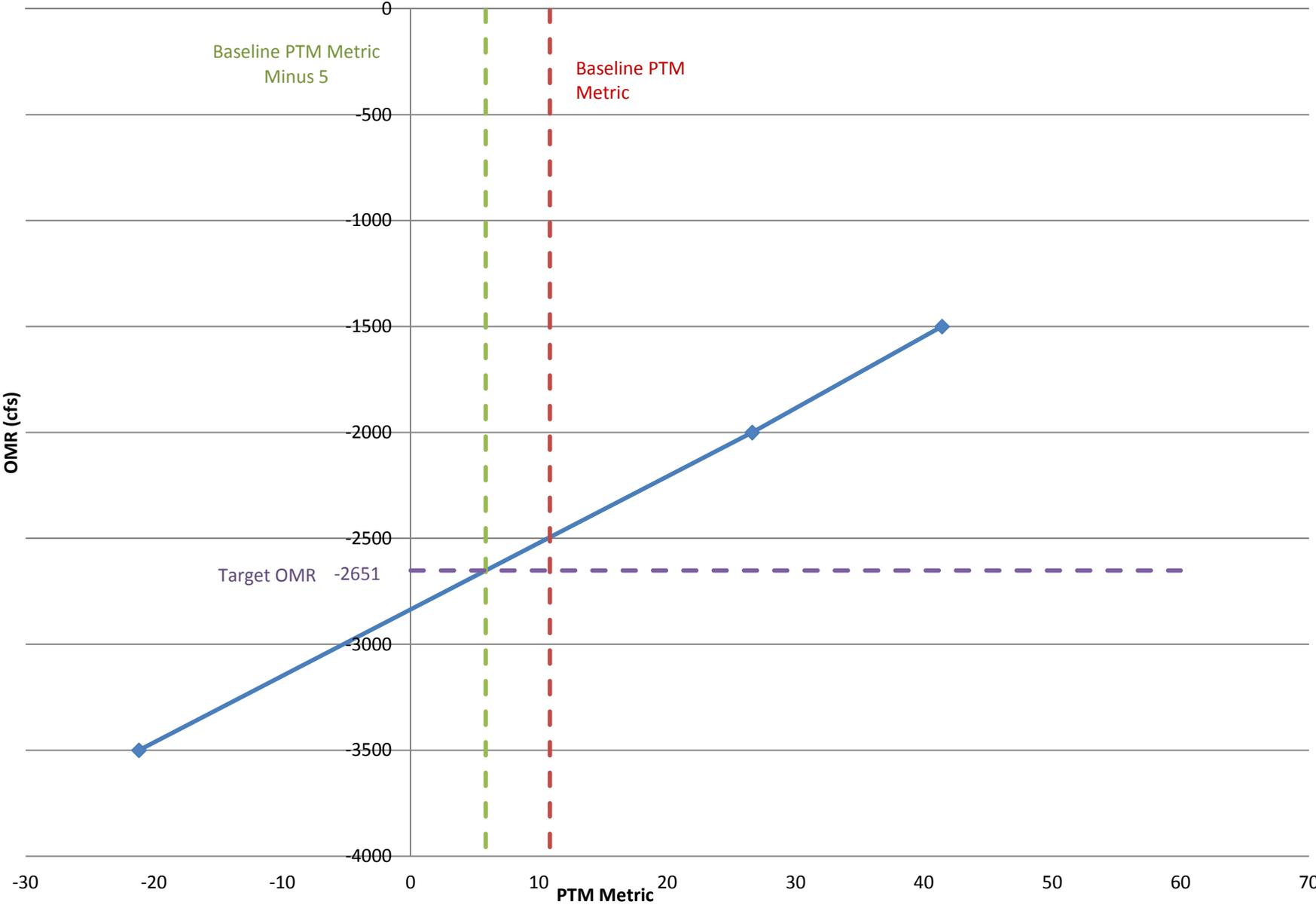
# OMR Flows and 28 Day PTM Metric with San Joaquin River at 2500 cfs



# OMR Flows and 50% Fate PTM Metric with San Joaquin River at 2500 cfs



# OMR Flows and 84 Day PTM Metric with San Joaquin River at 2500 cfs



28 Days

Scenario ID	% to CVP at 28 days	% Chipps at 28 days	% SWP at 28 days	PTM Metric at 28 days
A	1.2	9.5	3.2	5.1
B	1.6	15.2	0.8	12.8
C	3.3	12.2	2.8	6.2
D	13.4	7.4	12.8	-18.8

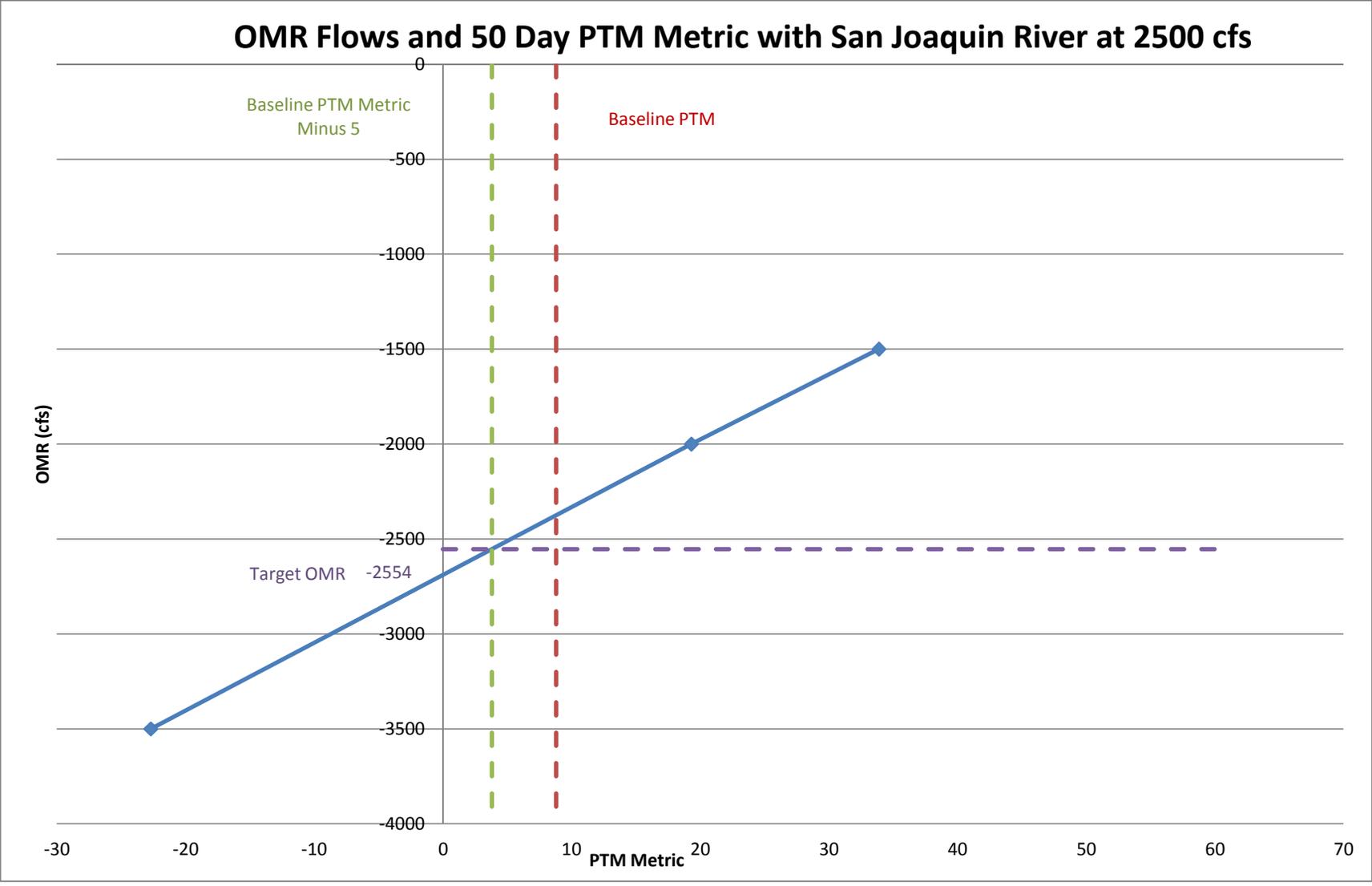
84 Days

Scenario ID	% to CVP at 84 days	% Chipps at 84 days	% SWP at 84 days	PTM Metric at 84 days
A	5.1	38.5	22.6	10.9
B	7.4	59.9	11.1	41.4
C	10.1	52.5	15.8	26.6
D	23.3	29.8	27.6	-21.2

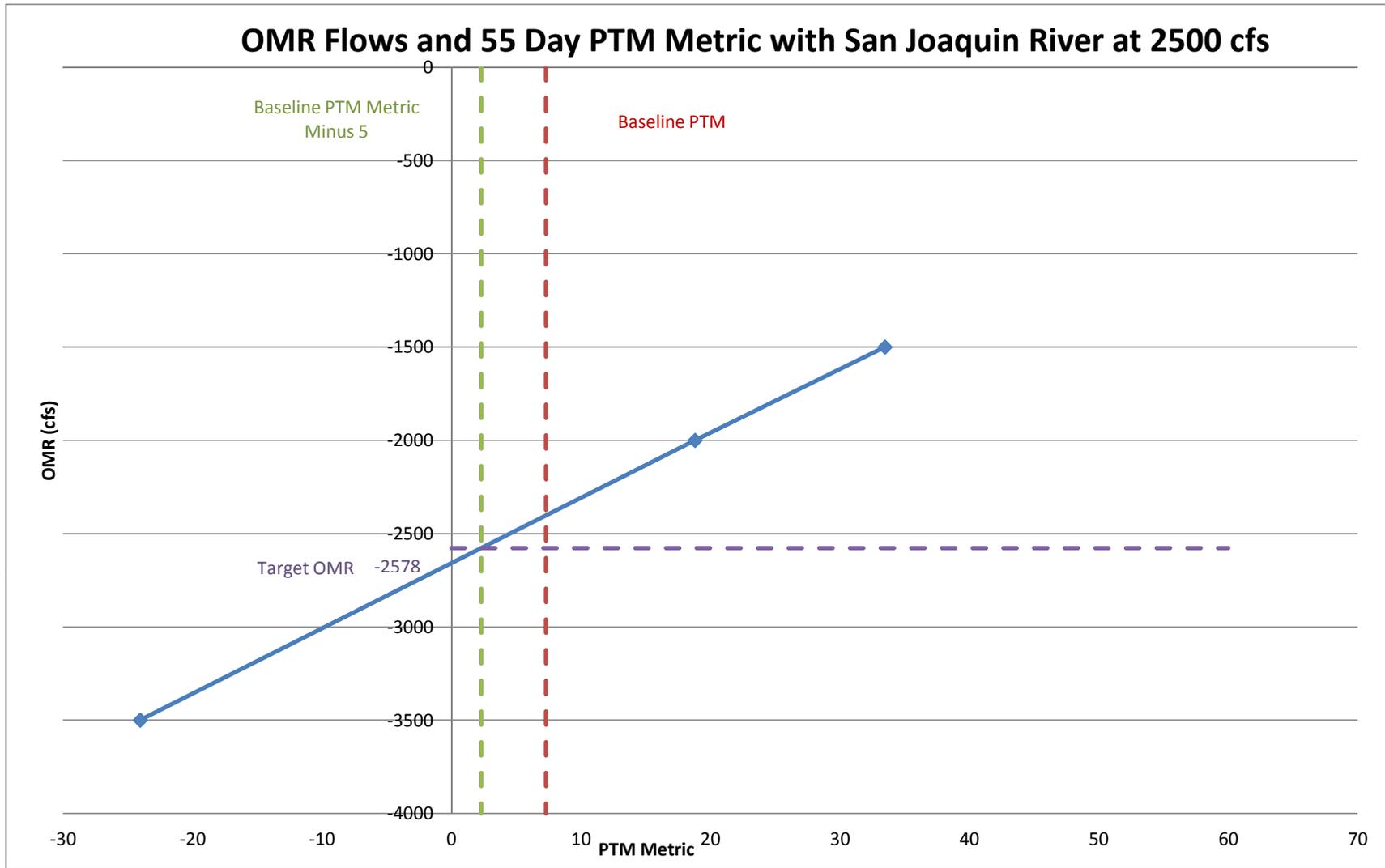
50% Particle Fate

Scenario ID	Number of Days	50% CVP	50% SWP	50% Chipps	PTM Metric
A	55	3.7	16.2	27.2	7.3
B	50	5.6	6.1	45.6	33.9
C	49	8.0	10.8	38.4	19.6
D	38	18.0	19.4	12.7	-24.7

### OMR Flows and 50 Day PTM Metric with San Joaquin River at 2500 cfs



### OMR Flows and 55 Day PTM Metric with San Joaquin River at 2500 cfs



28 Days

Scenario ID	% Chipps at 28 days	% to CVP at 28 days	% SWP at 28 days	PTM Metric at 28 days
A	9.5	1.2	3.2	5.1
B	15.2	1.6	0.8	12.8
C	12.2	3.3	2.8	6.2
D	7.4	13.4	12.8	-18.8

50 Days

Scenario ID	% Chipps at 50 days	% to CVP at 50 days	% SWP at 50 days	PTM Metric at 50 days
A	26.3	3.4	14.1	8.8
B	45.6	5.6	6.1	33.9
C	38.5	8.1	11.1	19.3
D	21.4	20.7	23.5	-22.7

55 Days

Scenario ID	% Chipps at 55 days	% to CVP at 55 days	% SWP at 55 days	PTM Metric at 55 days
A	27.2	3.7	16.2	7.3
B	47.0	6.1	7.4	33.5
C	39.9	8.6	12.4	18.8
D	22.0	21.4	24.7	-24.0

84 Days

Scenario ID	% Chipps at 84 days	% to CVP at 84 days	% SWP at 84 days	PTM Metric at 84 days
A	38.5	5.1	22.6	10.9
B	59.9	7.4	11.1	41.4
C	52.5	10.1	15.8	26.6
D	29.8	23.3	27.6	-21.2

50% Particle Fate

Scenario ID	Number of Days	50% Chipps	50% CVP	50% SWP	PTM Metric
A	55	27.2	3.7	16.2	7.3
B	50	45.6	5.6	6.1	33.9
C	49	38.4	8.0	10.8	19.6
D	38	12.7	18.0	19.4	-24.7

# **Appendix H**

NMFS Determination on April 12, 2012



**UNITED STATES DEPARTMENT OF COMMERCE  
National Oceanic and Atmospheric Administration**

NATIONAL MARINE FISHERIES SERVICE  
Southwest Region  
501 West Ocean Boulevard, Suite 4200  
Long Beach, California 90802-4213

**APR 12 2012**

Mr. Donald R. Glaser  
Regional Director  
Mid-Pacific Region  
U.S. Bureau of Reclamation  
2800 Cottage Way, MP-3700  
Sacramento, California 95825-1898

Mr. Mark W. Cowin  
Director  
California Department of Water Resources  
P.O. Box 942836, Room 1115-1  
Sacramento, California 94236-0001

Dear Mr. Glaser and Mr. Cowin:

On January 12, 2012, Plaintiffs, Plaintiff-Intervenor, and Federal Defendants to the Consolidated Salmonid Cases (Case 1:09-cv-01053-LJO --DLB) signed and filed with the Federal court a joint stipulation (Document 659-2) that included Central Valley Project and State Water Project operations for April and May 2012. On March 16, 2012, NMFS transmitted to the U.S. Bureau of Reclamation (Reclamation) and the California Department of Water Resources (DWR) the real-time operations technical memorandum required as part of the joint stipulation (Paragraph 2.a.v).

On April 4, 2012, NOAA's National Marine Fisheries Service (NMFS) issued a letter to Reclamation and DWR with its determination that operating to an OMR flow of no more negative than -2,500 cfs from April 8-14, 2012, as measured by a 5-day running average that may not be more negative than -3,125 cfs, is consistent with the intent and objective of OMR flow management, as provided in the technical memorandum.

On April 6, 2012, at 5:00 pm, DWR submitted to NMFS a proposal that stated the Delta Conditions Team (DCT), DWR, and the Public Water Agencies (PWA) were requesting that the Federal and State water projects target an OMR flow of -3,500 cfs throughout the remainder of April 2012. However, upon further inquiry, NMFS determined that the proposal was neither submitted nor reviewed by the DCT. Therefore, NMFS requested that the proposal be reviewed by the DCT, in accordance with the process provided in the joint stipulation (page 5, paragraph iv). The DWR/PWA proposal was subsequently reviewed by the DCT and discussed at



its Monday afternoon, April 9, 2012, meeting, and also reviewed immediately thereafter by the Delta Operations for Salmonids and Sturgeon (DOSS) group at its Tuesday morning, April 10, 2012, meeting.

The enclosure provides DOSS advice to the Water Operations Management Team (WOMT) and NMFS. DOSS advised WOMT and NMFS to: (1) *not* adopt the proposed change to OMR of -3,500 cfs for the remainder of the April 8-14, 2012 time period (and therefore, continue implementing the OMR limit of -2,500 cfs<sup>1</sup> as provided in the April 4, 2012, NMFS determination), and (2) the proposal to operate to an OMR limit of -3,500 cfs from April 15-30, including the acoustically tagged steelhead exposure criterion, was consistent with the OMR values and criteria contained in the March 16<sup>th</sup> NMFS technical memorandum.

NMFS determines, similar to its April 4, 2012, determination, that since the OMR flow of no more negative than -2,500 cfs for April 8-14, 2012, is consistent with the joint stipulation and associated technical memorandum, that it will avoid jeopardizing the continued existence of Central Valley steelhead<sup>1</sup>. NMFS concurred with DOSS that the DWR/PWA proposal to operate to an OMR limit of -3,500 cfs from April 15-30, 2012 (unless the acoustically tagged steelhead exposure criterion, as defined in the technical memorandum, is exceeded), is equivalent to the OMR values and criteria contained in the technical memorandum, and therefore, will be implemented as planned.

The joint stipulation (page 4, paragraph v) provides examples of relevant available scientific information and considerations, in addition to the hydrodynamics and Particle Tracking Model runs, that should be considered in the development of the real-time operations technical memorandum and screening criteria. Enclosed are sources of information provided in the joint stipulation, and how NMFS and the technical memorandum planning/drafting committee and DOSS utilized and considered each source of information.

NMFS appreciates the continued coordination of the parties towards the implementation of the joint stipulation and the technical memorandum.

Sincerely,



Rodney R. McInnis  
Regional Administrator

Enclosures:

1. DOSS advice
2. DWR/PWA proposal
3. Use of data in the implementation of the joint stipulation

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<sup>1</sup> The 5-day running average of OMR flow during this period shall be no more than 25% more negative than -2,500 cfs (*i.e.*, -3,125 cfs).

**DOSS Advice for operations for the remainder of the April 8-April 14, 2012, time period**

**Old and Middle River Flow Management per the 2012 Joint Stipulation, in lieu of Action IV.2.1 of the NMFS Biological Opinion for the Long-Term Operations of the Central Valley Project and State Water Project (NMFS Opinion)**

**Summary of Advice from the Delta Operations for Salmonids and Sturgeon (DOSS) group:**

**Background:**

The California Department of Water Resources (DWR) and the Public Water Agencies (PWA) submitted a proposal (Attachment 1) to NMFS on April 6, 2012, to operate to an Old and Middle River (OMR) flow of no more negative than -3,500 cfs for the rest of April. This proposal was subsequently submitted to the Delta Conditions Team for discussion and consideration during its meeting on Monday afternoon, April 9, 2012, and the DOSS meeting on Tuesday morning, April 10, 2012. The proposal represents a change in operations from the expected operations for the remainder of week of April 8-14, during which an OMR target of -2,500 cfs is currently being implemented. DOSS reviewed the proposal and some additional information received from individual members of the Delta Conditions Team (DCT).

**DOSS advice for Tuesday 4/10/12:**

Remainder of April 8-14, 2012, time period: For the remainder of the April 8-14 time period, DOSS advises to *not* adopt of the DWR/PWA proposed change to a target OMR of -3,500 cfs (and therefore, continue implementing the OMR limit of -2,500 cfs as provided in the April 4, 2012, NMFS determination. Compliance will be measured using a 5-day running average that may be no more than 25% more negative than the target OMR, *i.e.* no more negative than -3,125 cfs.).

Rationale for Advice for remainder of April 8-14, 2012, time period:

DOSS did not advise adoption of the proposal because there was not full confidence that the evidence provided was sufficient to show that the proposed operations were as protective to San Joaquin basin steelhead as the RPA Action (Action 4.2.1) the stipulated operations are intended to replace, and not enough time to conduct additional analysis using DSM2 Hydro data. One important concern was that the individual hydrodynamic effects (measured over small spatial and temporal scales) were not evaluated in combination, making it difficult to evaluate the overall change in protection that might result from the cumulative effect of the reported changes to individual effects.

April 15-30: For the first experimental period of April 15-April 30, DOSS advises WOMET and NMFS to accept the DWR/PWA proposal to operate to an OMR limit of -3,500 cfs from April 15-30, unless the acoustically tagged steelhead exposure criterion, as defined in the technical memorandum, is exceeded. An OMR target of -3,500 cfs over this period is consistent

with both the operations proposed for April 15-30 in the OMR technical memorandum (see Table 1 of the OMR technical memorandum).

April 6, 2012

From: Delta Conditions Team, DWR and Public Water Agencies

To: DOSS

Subject: Alternative Operations during April 2012

The Department of Water Resources (DWR) and public water agencies (PWA) are providing an alternative operations plan to the Delta Operations for Salmonids and Sturgeon (DOSS) Group for April, 2012. The March 16, 2012 Technical Memorandum to Guide Adaptive Management of OMR during April and May 2012 (Tech Memo) provides the opportunity for the Delta Conditions Team (DCT), convened by DWR, to provide information to assist DOSS in evaluating effects of planned water operations on salmonids.

In the January 19, 2012 Joint Stipulation Regarding CVP and SWP Operations in 2012 (Stipulation), the parties agreed that the National Marine Fisheries Service (NMFS) should develop real-time operations screening criteria based on a variety of relevant available scientific information including results from trawls and rotary screw traps, salvage, hydrodynamics, empirical data from previous VAMP studies, survival equations, and a modified Delta Passage Model (Section 2.a.v.), and a broadened steelhead acoustic tagging and release program (Section 2.a.vi.). However, the March 16, 2012 Tech Memo and subsequent March 28, 2012 DOSS Advice for operations from April 1-April 7, 2012 present an operations management plan for the first two weeks of April based solely on the results of PTM (Section III.) The alternative operations plan presented here has been developed considering the additional information indicated in the Stipulation, specifically, the hydrodynamics and previous VAMP information.

The proposal has been developed based upon our understanding of the broader range of scientific factors (in addition to PTM analysis) that are specified in the stipulation. We believe that consideration of these other factors results in a plan that provides protection for fisheries in balance with current adverse water supply conditions, recognizing the extreme shortage in supply for CVP Contract Water Users specifically, who are currently receiving a 30% allocation.

#### THE PROPOSAL

DWR and the PWA proposes targeting -3,500 cfs Old and Middle rivers (OMR) flow in April, provided for in the January 19, 2012 Joint Stipulation Regarding CVP and SWP Operations in 2012 (Stipulation), unless 1) salmonid loss density criteria, defined in the National Marine Fisheries Service (NMFS) 2009 Biological Opinion for Long Term Operations of the Central Valley Project and State Water Project (BO), Reasonable and Prudent Alternatives (RPA) Action IV.2.3, are exceeded, or 2) acoustically tagged steelhead exposure criteria, defined in the Technical Memo, are exceeded.

#### RATIONALE:

We cite three lines of evidence that the proposed -3,500 OMR flow in April will not pose increased risk to survival of steelhead smolts. Foremost, the DSM2 Hydro simulations show clearly that the difference of flow diverted to the interior Delta at the Old and Middle River junctions with the San Joaquin will increase by less than half of 1% (0.5%) as negative OMR increases from -2500 cfs to -3500 cfs. Second, the PTM results are not reliable for predicting smolt movements, because they do not correspond with results from recoveries of CWT marked smolts during VAMP experiments. Finally, fish density triggers are in place to signal the need to curtail negative OMR flows if more fish enter Old and Middle River than expected.

**Change in proportion of flow entering the interior Delta will be negligible.** At the present inflow from the San Joaquin River at Vernalis (1730 cfs on Apr 4), the installation of HORB causes the percentage of flow entering the mouths of Old River and Middle River to increase by less than 0.3% from that without HORB (Attachment 1, Table 1). Further, that tiny increase shows almost no change in response to export pumping volume/OMR flows (Attachment 1, Figure 1 and Table 2). No change in the percentage of flow entering Old River is detectable as negative OMR flows change from -2,500 cfs to -5,000 cfs, and the percentage of flow entering Middle River actually decreases as OMR flows become more negative (Attachment 1, Table 1). Further, decreasing OMR flows have a very small effect on the duration of positive OMR flows (Attachment 1 Figure 2), magnitude of maximum negative OMR flow velocities (Attachment 1, Figure 3), or extent of negative average flows in the Delta (Attachment 1, Figure 4).

DSM2 Hydro outputs express volumes of flow and their direction at 15-minute increments, which are similar to the time steps within which juveniles arriving at a channel junction make the choice of which route to take leading out of the junction. Further, the telemetry studies cited in the Technical Memorandum have consistently shown that juvenile salmonids exit channel junctions in proportion to the flow splits exiting the junction. In contrast, none of the telemetry studies have shown that the fraction of fish choosing different exits at a junction is highly related to particle fates 28 days later. Further, the PTM results are widely divergent from both the the DSM2 Hydro results and the CWT results (as discussed below).

PTM and DSM2 Hydro results on day one of the simulations show very little effect from varying OMR flows (Attachment 1, Figure 5). PTM results for both total proportion of particles to the interior and effect of varying OMR flows begin to diverge from DSM2 Hydro results on day 2. By day 15 of the PTM simulations, PTM results diverge widely from DSM2 Hydro results for both the proportion of flow to the interior Delta and the effect of varying OMR flows. Further, the DSM2 Hydro results more closely match the expected hydrodynamic conditions experienced by migrating juvenile salmonids.

**Particle Tracking Model Analysis is inconsistent with Coded Wire Tag Studies.**  
The sole reliance on Particle Tracking Model (PTM) results to simulate salmonid

behavior during the first two weeks of April, 2012 is not appropriate because particles in PTM are most similar to "packets of water" moving in the system, not juvenile salmonids that are actively swimming organisms with behavioral characteristics. The PTM does not simulate any behavior for outmigrating salmon and provides results that are significantly different than available coded wire tagged (CWT) studies. To determine the efficacy of PTM results simulating salmonid behavior, DWR compared 24 juvenile Chinook experimental releases in the lower San Joaquin River to associated PTM results. The 24 experimental releases were conducted for the VAMP from 1995 to 2006. These experimental releases were conducted using CWT hatchery origin juvenile Chinook released at Mossdale and Durham Ferry, upstream of the export facilities, and recaptured at Chipps Island, downstream, at the western boundary of the Delta. The purpose of the VAMP experiments was to try to determine the effects of flow and exports on juvenile Chinook. Since there are no such juvenile steelhead experiments on the lower San Joaquin River, we use Chinook as the closest surrogate for juvenile steelhead.

The figures in Attachment 2 are a comparison of the daily passage at Chipps Island of CWT juvenile Chinook and particles from associated PTM results for individual experimental releases. All the releases occur during the months of April and May. The fish releases were made at Mossdale from 1995 through 2004, and then at Durham Ferry, just upstream, from 2005 through 2006. There are usually 2 experimental releases each year, but there were 3 in 1995 and 1998, and only 1 in 1997 and 2004. All of the PTM studies used the same release dates and hydrology as the fish studies and used a constant 5,000 particles in each of the PTM studies. There are no figures past 2006 because, after 2006, FWS started using radio tagging instead of CWT tagging. Both the CWT and PTM data are presented in terms of percentages of CWT recoveries and particle passage at Chipps to standardize and evaluate the results from year to year. The left y-axes are the percentage of CWT Chinook recovered at Chipps, and the right y-axes are the percentage of particles passing Chipps Island on a daily time step.

Two characteristics are apparent from the graphs in Attachment 2: the trend of the timing of CWT Chinook recoveries at Chipps Island compared to PTM results, and the trend of the magnitude of CWT Chinook recoveries at Chipps Island compared to PTM results. The only years for which the timing of the CWT recoveries at Chipps were associated with the timing of the particles past Chipps were 1995, 1998 and 2006. Those were the three very high San Joaquin River flow years; flows greater than 20,000 cfs. The rest of the years, the CWT timing of recoveries at Chipps was much earlier than the particle timing past Chipps. Most years, there was little overlap between the CWT recoveries and particles passing Chipps. In the lowest flow years, 2000 through 2004, there was no overlap between the timing of the CWT recoveries at Chipps and the passing of particles past Chipps. In those lowest flow years, the CWT Chinook passed Chipps Island within about two weeks, regardless of the PTM results. The CWT Chinook actively swim downstream when compared to the neutrally buoyant particles.

The magnitude of recoveries of CWT Chinook at Chipps Island compared to the magnitude of particles passing Chipps Island was also not well associated. The only year for which the magnitude of CWT Chinook recovered at Chipps was relatively similar to the magnitude of particles passing Chipps Island was 1998. For the other two high flow years, 1995 and 2006, the recoveries of CWT Chinook at Chipps Island were relatively low. For the low flow years 1999 through 2001, the recoveries of CWT Chinook was relatively high compared to particles passing Chipps Island.

**Fish density triggers protect smolts.** In the event that more smolts turn into the interior Delta than expected, two fish density triggers are in place to detect the fish and reduce negative OMR flows. One trigger is determined from steelhead captures at the Delta Fish facilities, and the other is related to detections of acoustically tagged steelhead passing through routes leading to the pumps.

# Attachment 1

# Table 1. Change in Flow to Interior Delta with HORB In vs Out Under Varying Inflow and OMR Flows

Proportion of Flow Entering Interior Delta Over 24 Hours: HORB In - Out												
From Upstream+Downstream: 1500 cfs Inflows				From Upstream: 1500 cfs Inflows				From Downstream: 1500 cfs Inflows				
Junction	OMR Flows			Junction	OMR Flows			Junction	OMR Flows			
	-2500 cfs	-3500 cfs	-5000 cfs		-2500 cfs	-3500 cfs	-5000 cfs		-2500 cfs	-3500 cfs	-5000 cfs	
HOR	-21.72%	-22.17%	-22.67%	HOR	-14.10%	-14.41%	-14.76%	HOR	-7.63%	-7.76%	-8.03%	
TRN	1.23%	1.20%	1.19%	TRN	0.14%	0.09%	0.12%	TRN	1.09%	1.11%	1.07%	
COL	0.62%	0.66%	0.73%	COL	0.12%	0.14%	0.22%	COL	0.51%	0.52%	-0.36%	
MRV	0.21%	0.22%	0.17%	MRV	0.00%	0.00%	0.00%	MRV	0.21%	0.22%	0.17%	
ORV	0.26%	0.25%	0.26%	ORV	0.09%	0.08%	0.08%	ORV	0.17%	0.17%	0.18%	
FMN	0.00%	0.00%	0.00%	FMN	0.00%	0.00%	0.00%	FMN	0.00%	0.00%	0.00%	
FRV	0.02%	0.02%	0.02%	FRV	-0.03%	-0.02%	0.03%	FRV	0.05%	0.04%	-0.01%	
JPT	-0.10%	-0.12%	-0.13%	JPT	-0.10%	-0.11%	-0.14%	JPT	0.00%	0.00%	0.01%	
From Upstream+Downstream: 3000 cfs Inflows				From Upstream: 3000 cfs Inflows				From Downstream: 3000 cfs Inflows				
Junction	OMR Flows			Junction	OMR Flows			Junction	OMR Flows			
	-2500 cfs	-3500 cfs	-5000 cfs		-2500 cfs	-3500 cfs	-5000 cfs		-2500 cfs	-3500 cfs	-5000 cfs	
HOR	-33.30%	-33.67%	-34.03%	HOR	-32.18%	-32.51%	-32.80%	HOR	-1.11%	-1.17%	-1.24%	
TRN	2.39%	2.44%	2.57%	TRN	2.25%	2.12%	1.97%	TRN	0.14%	0.32%	0.61%	
COL	1.46%	1.45%	1.53%	COL	-0.07%	-0.04%	0.06%	COL	1.53%	1.49%	1.48%	
MRV	0.51%	0.44%	0.41%	MRV	0.00%	0.00%	0.00%	MRV	0.51%	0.44%	0.41%	
ORV	0.55%	0.53%	0.54%	ORV	0.10%	0.08%	0.08%	ORV	0.45%	0.45%	0.45%	
FMN	0.00%	0.00%	0.00%	FMN	0.00%	0.00%	0.00%	FMN	0.00%	0.00%	0.00%	
FRV	0.02%	0.02%	0.02%	FRV	0.06%	0.09%	0.13%	FRV	-0.04%	-0.08%	-0.11%	
JPT	-0.09%	-0.10%	-0.10%	JPT	-0.12%	-0.14%	-0.15%	JPT	0.03%	0.04%	0.05%	
From Upstream+Downstream: 6000 cfs Inflows				From Upstream: 6000 cfs Inflows				From Downstream: 6000 cfs Inflows				
Junction	OMR Flows			Junction	OMR Flows			Junction	OMR Flows			
	-2500 cfs	-3500 cfs	-5000 cfs		-2500 cfs	-3500 cfs	-5000 cfs		-2500 cfs	-3500 cfs	-5000 cfs	
HOR	-35.30%	-35.35%	-35.39%	HOR	-35.30%	-35.35%	-35.39%	HOR	0.00%	0.00%	0.00%	
TRN	2.18%	2.35%	2.62%	TRN	1.69%	1.88%	2.17%	TRN	0.49%	0.48%	0.45%	
COL	1.96%	2.09%	2.26%	COL	1.51%	1.47%	1.43%	COL	0.45%	0.62%	0.83%	
MRV	1.93%	1.71%	1.60%	MRV	0.00%	0.00%	0.00%	MRV	1.93%	1.71%	1.60%	
ORV	1.29%	1.25%	1.20%	ORV	0.04%	0.03%	0.06%	ORV	1.25%	1.22%	1.14%	
FMN	0.00%	0.00%	-0.01%	FMN	0.00%	0.00%	-0.01%	FMN	0.00%	0.00%	0.00%	
FRV	-0.23%	0.01%	0.01%	FRV	-0.15%	0.36%	0.40%	FRV	-0.08%	-0.36%	-0.39%	
JPT	-0.04%	-0.05%	-0.05%	JPT	-0.18%	-0.19%	-0.20%	JPT	0.15%	0.15%	0.15%	

Table 1. Change in proportion of flow to interior Delta with HORB In vs HORB out under varying San Joaquin River inflows and OMR flows. Inflows in the first week of April, 2012 most closely correspond to the 1,500 cfs inflows level.

# Figure 1. Change in DSM2 Hydro Based Prediction of Movement into the Interior Delta

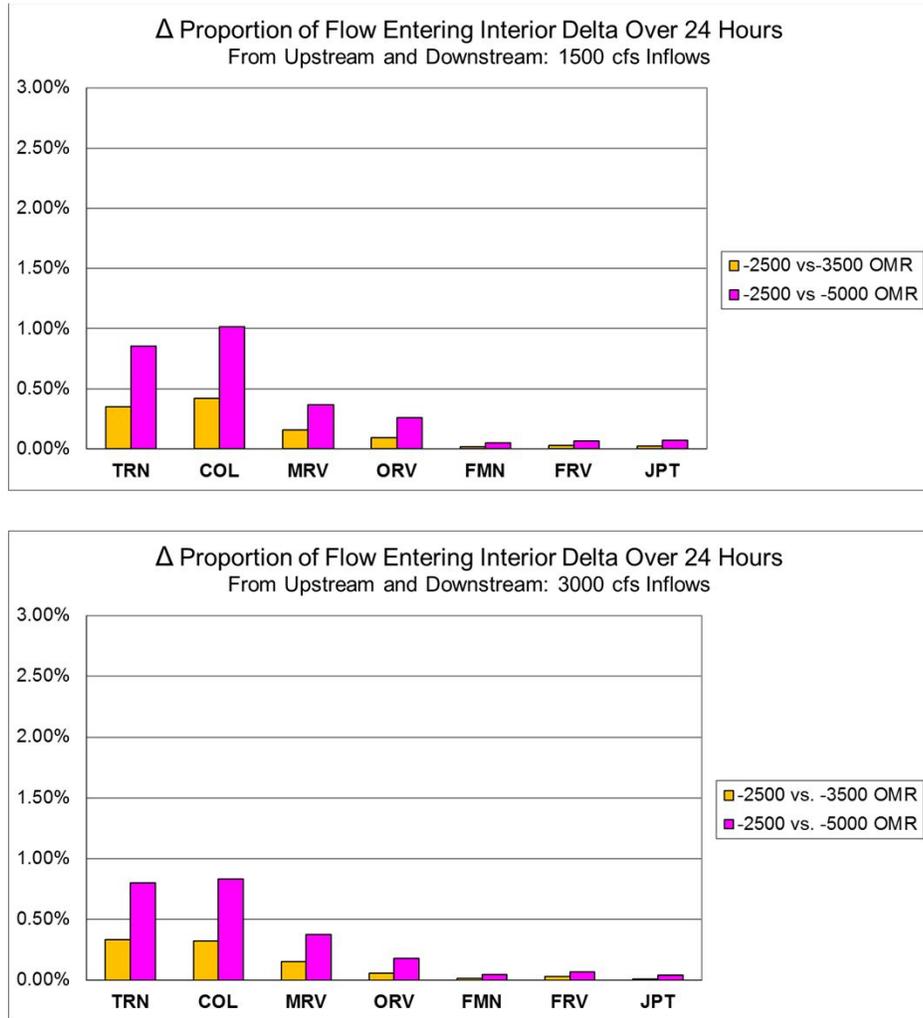


Figure 1. Change in the proportion of flow to the interior Delta (which closely correlates with expected changes in the movement of juvenile salmonids into the interior Delta) at junctions along the San Joaquin River as OMR flows decrease from -2500 to -3500 and from -2500 to -5000 cfs. The top panel shows values at San Joaquin River inflows of 1,500 cfs. The bottom panel shows values at San Joaquin River inflows of 3,000 cfs. The figure illustrates that changes in OMR flows are expected to have very little influence on the routing of fish.

## Table 2. Change in DSM2 Hydro Based Prediction of Movement into the Interior Delta

Δ Proportion of Flow Entering Interior Delta Over 24 Hours							
From Upstream+Downstream: 1500 cfs Inflows							
-2500 cfs OMR [~2863 cfs exports] vs. -3500 cfs OMR [~3927 cfs exports]				-2500 cfs OMR [~2863 cfs exports] vs. -5000 cfs OMR [~5523 cfs exports]			
Junction	OMR Flows		Δ Proportion	Junction	OMR Flows		Δ Proportion
	-2500 cfs	-3500 cfs			-2500 cfs	-5000 cfs	
TRN	15.11%	15.46%	0.35%	TRN	15.11%	15.96%	0.86%
COL	14.28%	14.70%	0.42%	COL	14.28%	15.30%	1.02%
MRV	18.11%	18.27%	0.16%	MRV	18.11%	18.48%	0.37%
ORV	15.24%	15.33%	0.09%	ORV	15.24%	15.50%	0.26%
FMN	2.38%	2.40%	0.02%	FMN	2.38%	2.43%	0.05%
FRV	16.83%	16.85%	0.03%	FRV	16.83%	16.89%	0.06%
JPT	6.56%	6.58%	0.02%	JPT	6.56%	6.64%	0.07%
From Upstream+Downstream: 3000 cfs Inflows							
-2500 cfs OMR [~2989 cfs exports] vs. -3500 cfs OMR [~4053 cfs exports]				-2500 cfs OMR [~2989 cfs exports] vs. -5000 cfs OMR [~5649 cfs exports]			
Junction	OMR Flows		Δ Proportion	Junction	OMR Flows		Δ Proportion
	-2500 cfs	-3500 cfs			-2500 cfs	-5000 cfs	
TRN	19.12%	19.45%	0.33%	TRN	19.12%	19.92%	0.80%
COL	16.14%	16.46%	0.32%	COL	16.14%	16.98%	0.83%
MRV	18.66%	18.81%	0.15%	MRV	18.66%	19.03%	0.37%
ORV	15.97%	16.03%	0.06%	ORV	15.97%	16.15%	0.18%
FMN	2.38%	2.39%	0.01%	FMN	2.38%	2.42%	0.04%
FRV	16.81%	16.84%	0.03%	FRV	16.81%	16.88%	0.07%
JPT	6.59%	6.60%	0.01%	JPT	6.59%	6.63%	0.04%

Table 2. Data used for Figure 1. Proportion of flow and change in proportion of flow (which are closely correlated with the expected movement and changes in the expected movement, respectively, of juvenile salmonids into the interior Delta) at junctions along the San Joaquin River as OMR flows decrease from -2500 to -3500 and from -2500 to -5000 cfs.

## Figure 2. Change in % Positive Flows: OMR -3500 vs. -2500

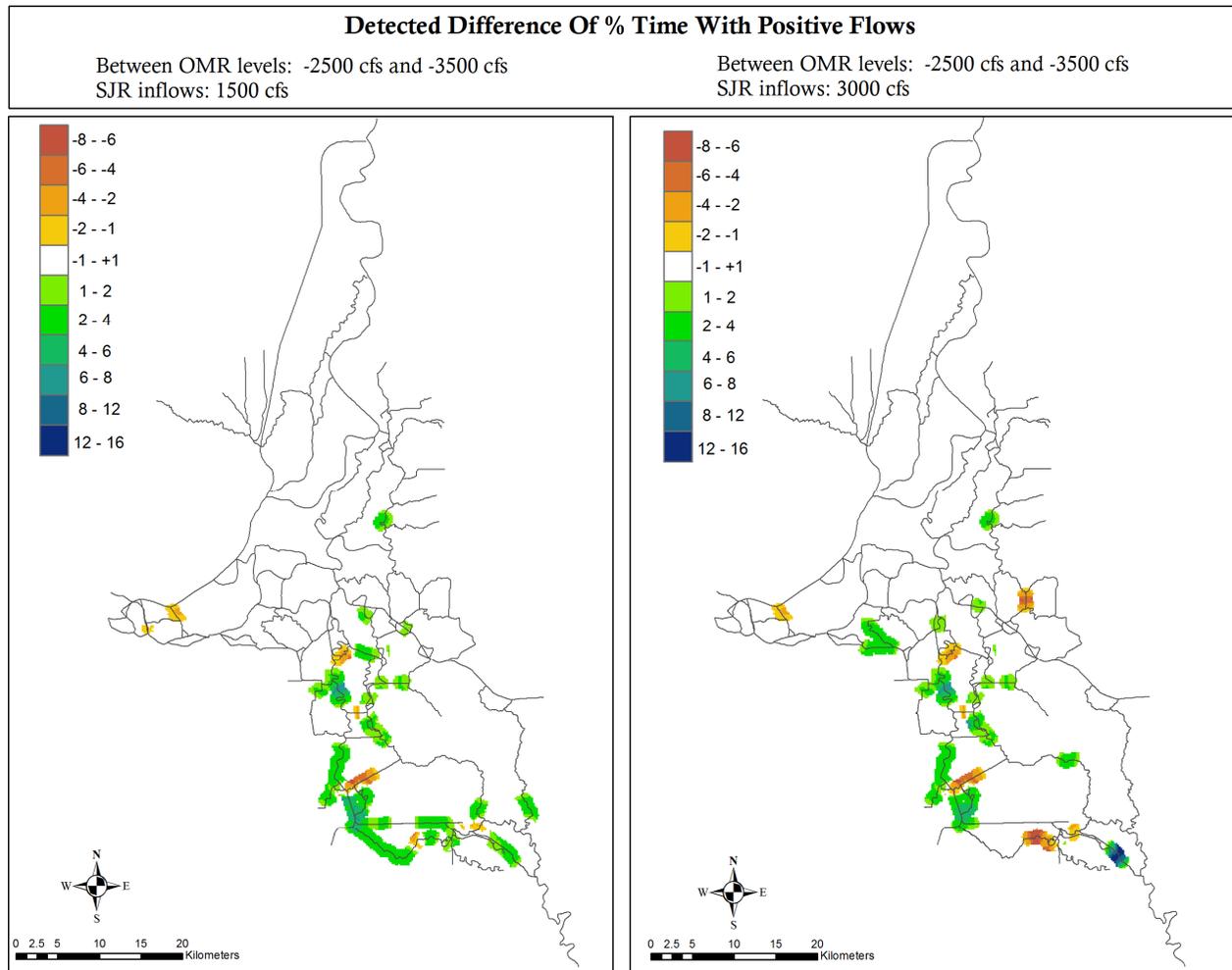


Figure 2. Percentage change in the occurrence of positive flows as OMR moves from -3500 cfs to -2500 cfs with San Joaquin River inflows at 1,500 cfs (left panel) and at 3,000 cfs (right panel). Yellow, orange, and red indicate 1 to 6% increase in occurrence of negative flows. Green and blue indicate positive flow increase in occurrence from 1 to 16%. The figure illustrates that more positive OMRs produce only slight changes, mostly in close proximity to export facilities, in the occurrence of positive flows.

# Figure 3. Change in Maximum Negative Velocities: OMR -3500 vs. -2500

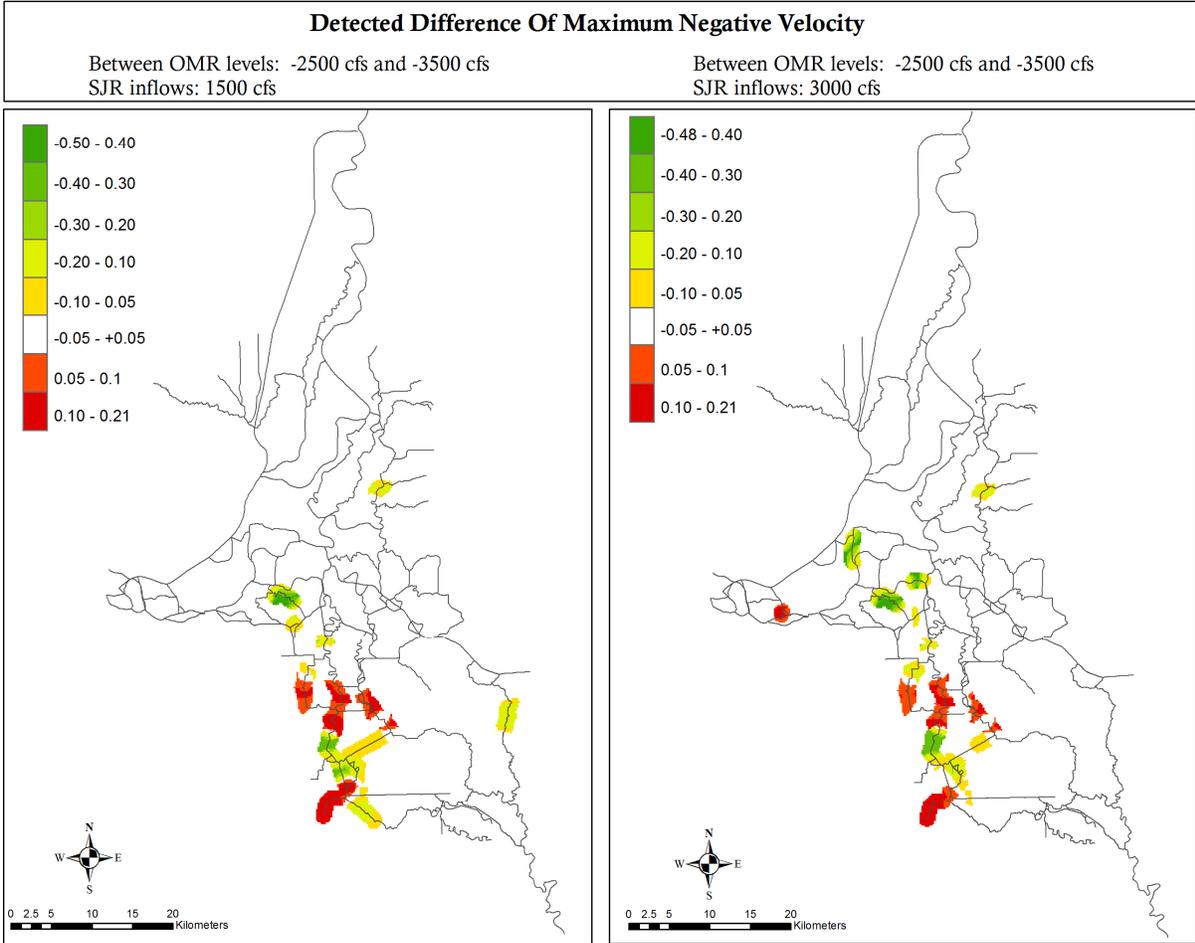


Figure 3. Change in maximum negative velocities as OMR moves from -3500 cfs to -2500 cfs with San Joaquin River inflows at 1,500 cfs (left panel) and at 3,000 cfs (right panel). Orange and red indicate 0.05 to 0.21 increase in negative velocities. Yellow and green indicate 0.05 to 0.50 decrease in negative velocities. The figure illustrates that more positive OMRs produce only slight changes, mostly in close proximity to export facilities, in the magnitude of negative velocities.

## Figure 4. Change in Average Daily Flows: OMR -3500 vs. -2500

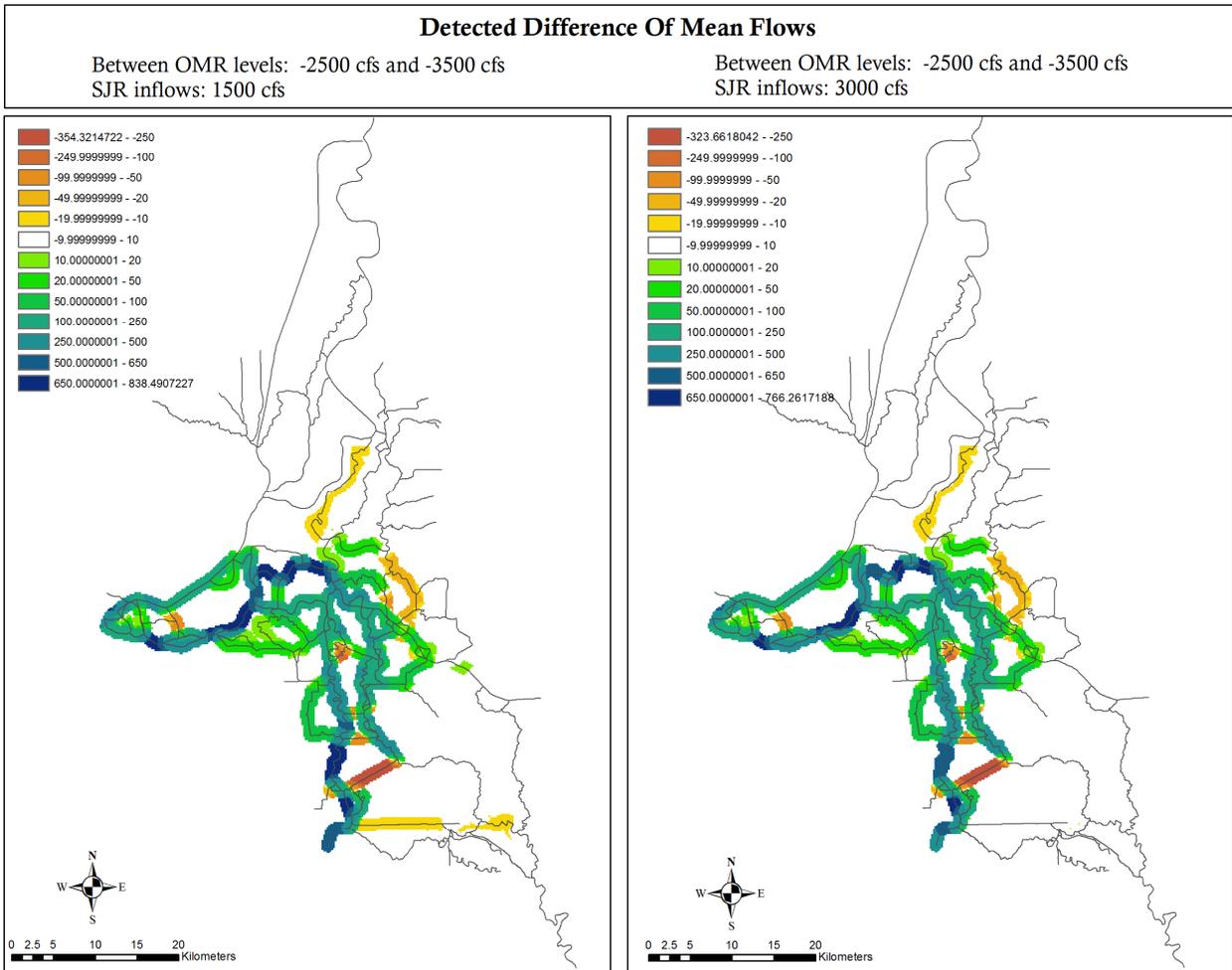


Figure 4. Change in the average daily (or “net”) flows as OMR moves from -3500 cfs to -2500 cfs with San Joaquin River inflows at 1,500 cfs (left panel) and at 3,000 cfs (right panel). Yellow, orange, and red indicate 10 to 350 cfs decreases in mean daily flows. Green and blue indicate 10 to 850 cfs increases in mean daily flows. The figure illustrates that more positive OMRs produce only slight changes in daily mean flows. Areas where greatest changes (dark blue) are observed are areas not identified as areas of concern by NMFS.

## Figure 5. PTM Results at Appropriate Time Scale, Compared to DSM2 Hydro Results

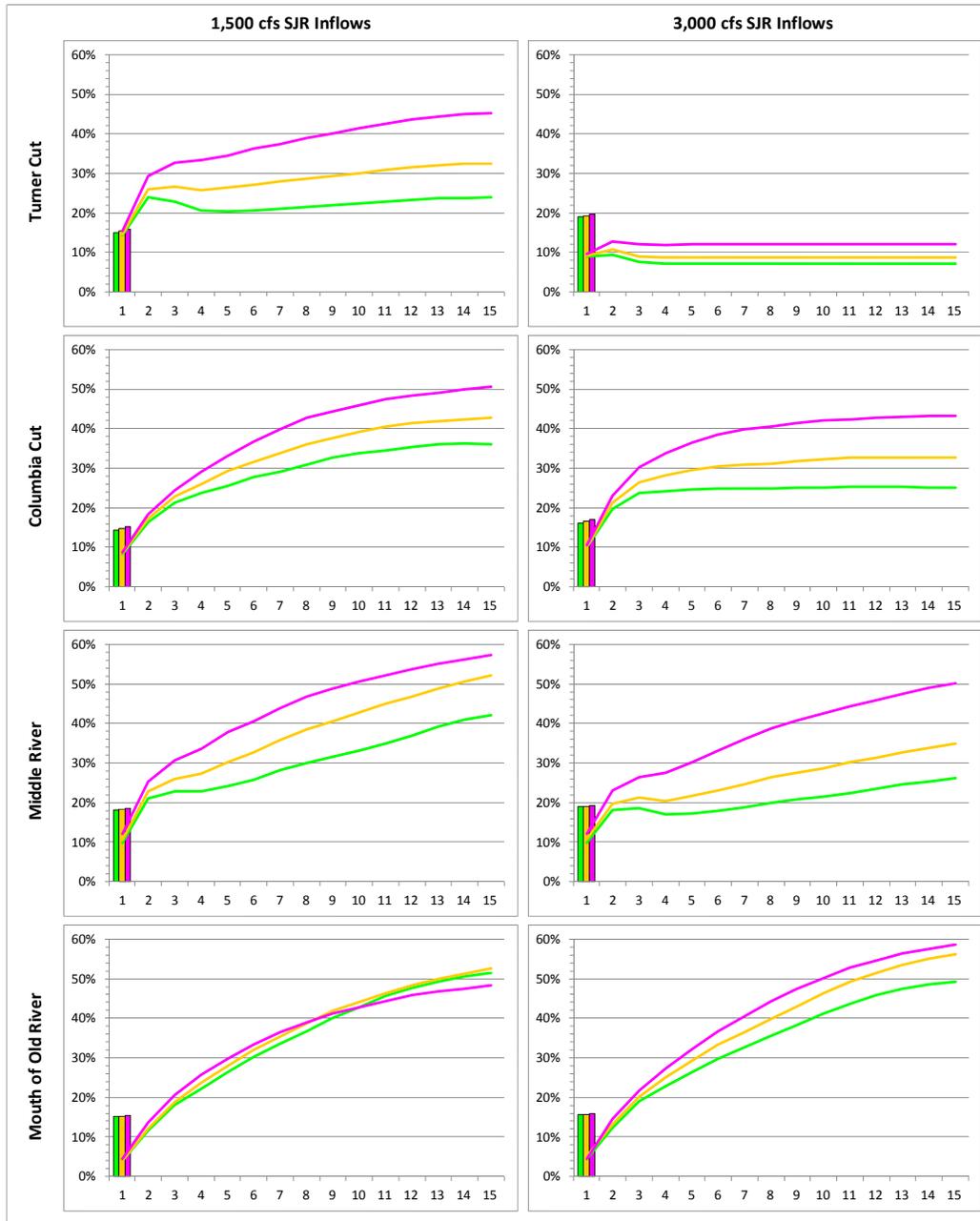
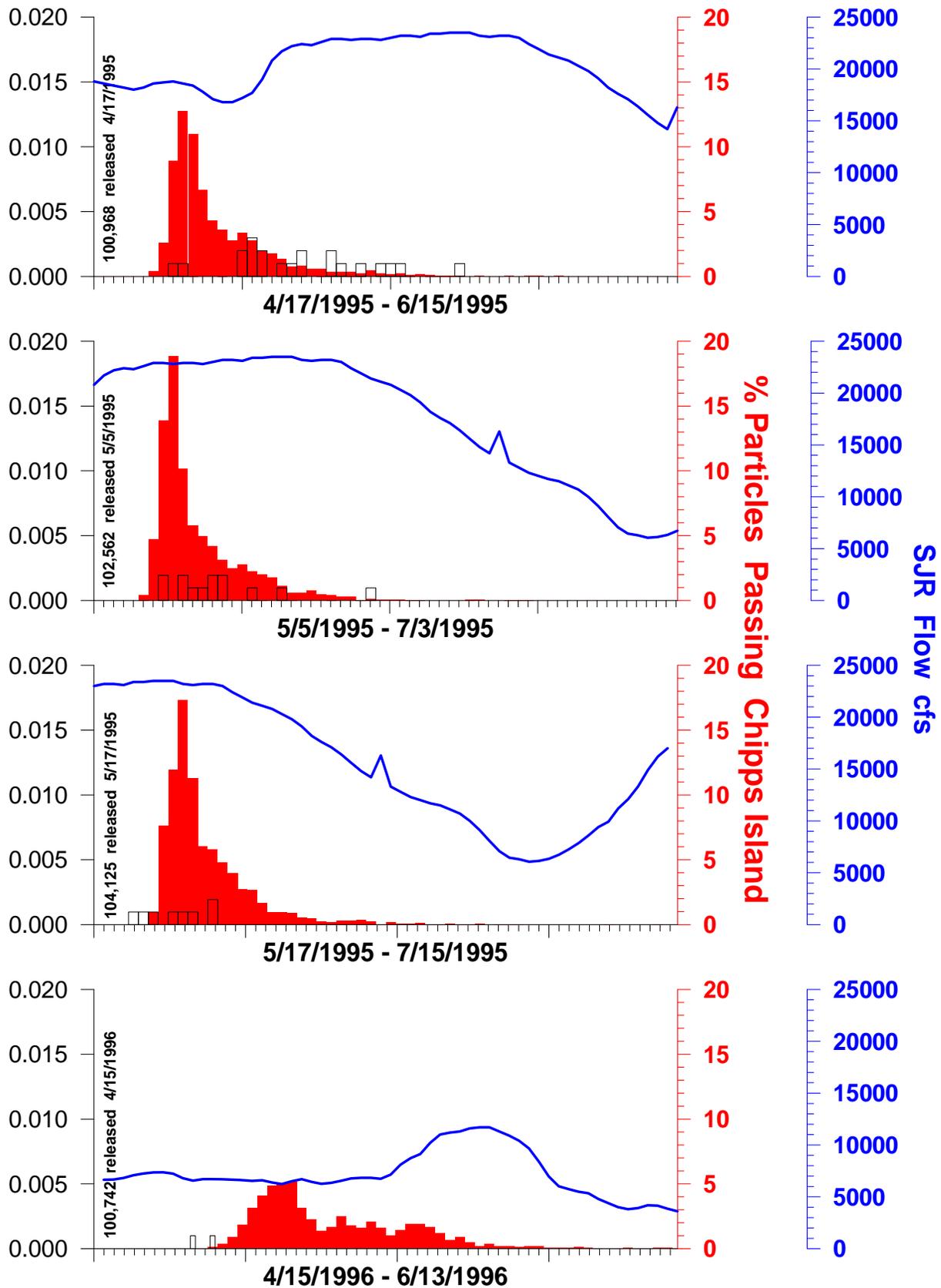


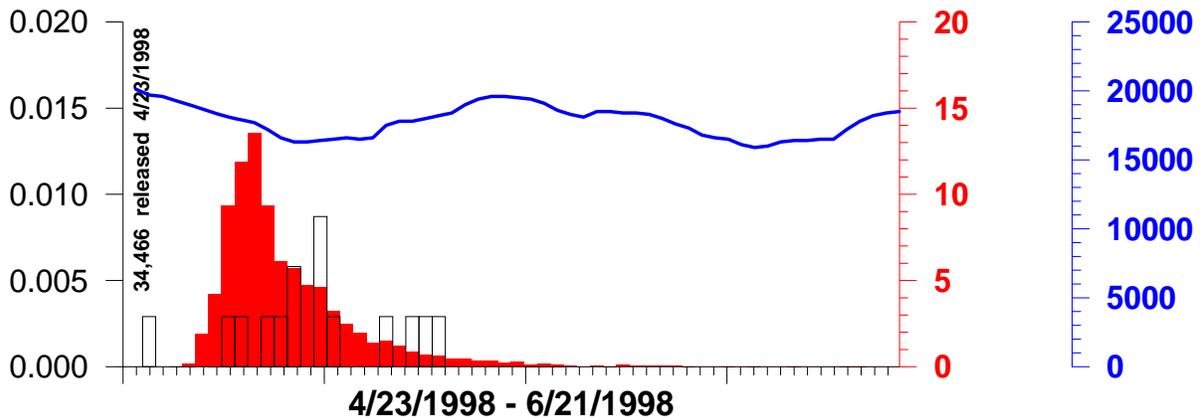
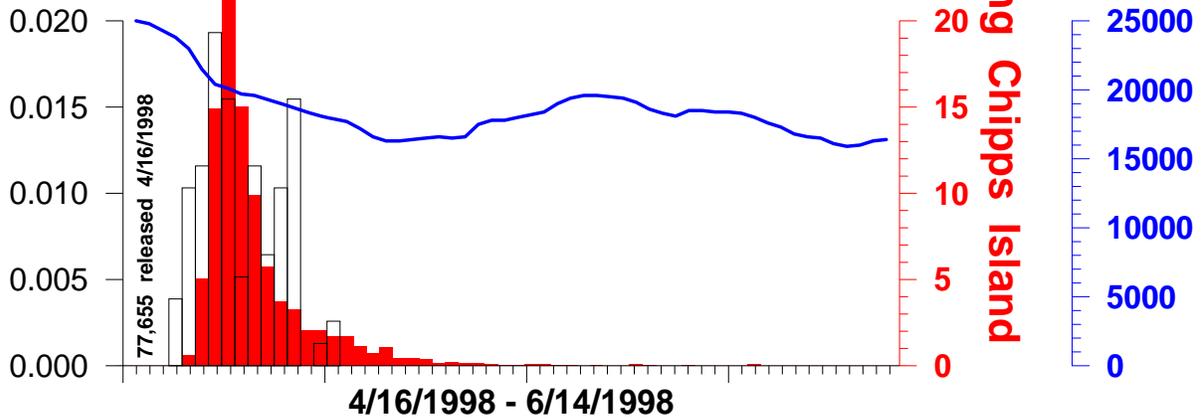
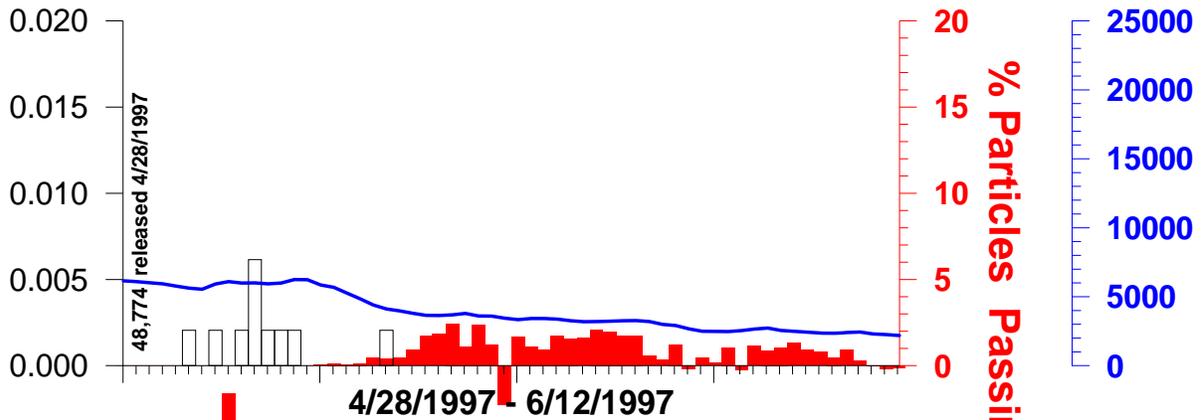
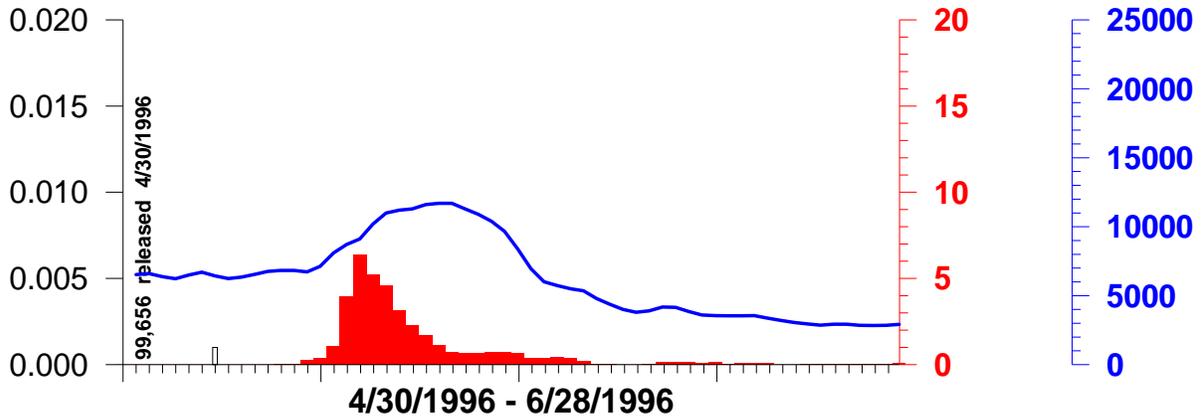
Figure 5. Daily PTM results for particles injected just upstream of key junctions which move into the interior Delta (lines) and comparable results for DSM2 Hydro analysis (bars) at two levels of San Joaquin River inflows (left and right panels). Green lines/bars represent -2500 cfs OMR. Orange lines/bar represent -3500 cfs OMR. Magenta lines/bars represent -5000 cfs OMR. The figure illustrates that PTM results are extremely sensitive to the time period over which the fate of particles is evaluated. Given their rapid migration through the Delta, juvenile salmonids would be expected to spend only about one day in the vicinity of any junction. PTM and DSM2 Hydro results at this time period show very little effect from varying OMR flows. PTM results at 15 days diverge widely from DSM2 Hydro results for both the proportion of flow to the interior Delta and the effect of varying OMR flows. The DSM2 Hydro results more closely match the expected hydrodynamic conditions experienced by migrating juvenile salmonids.

# Attachment 2

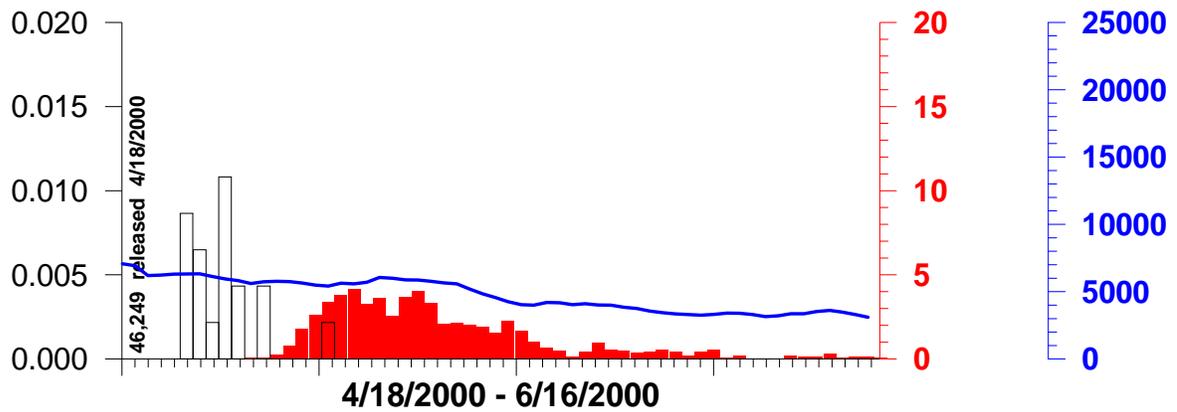
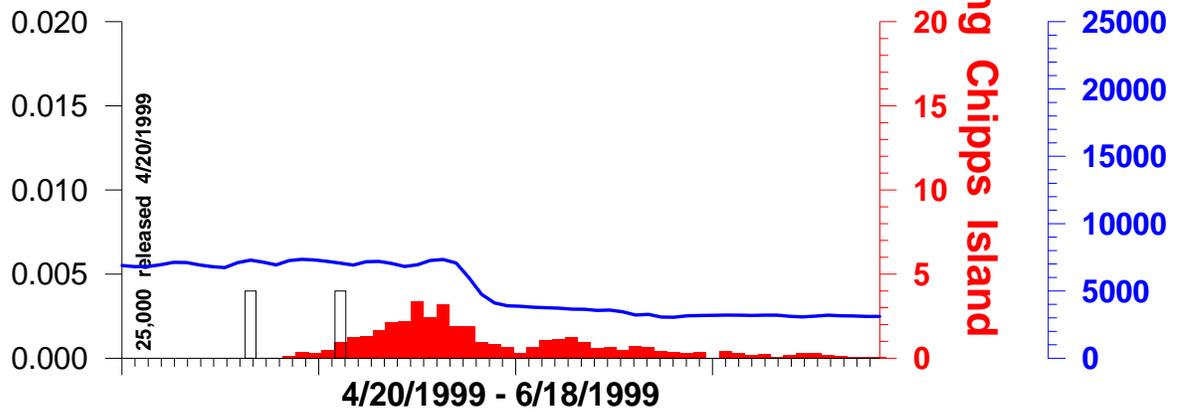
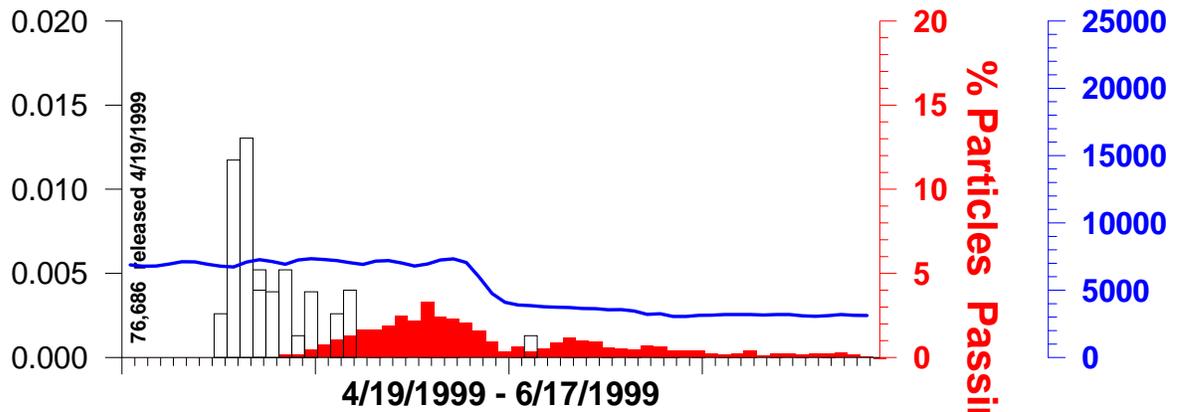
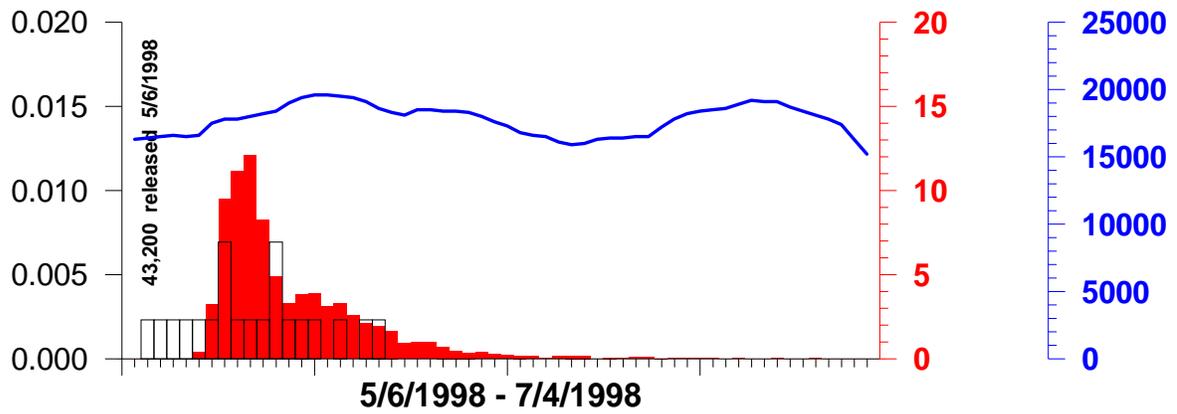
**% CWT Chinook Recovered at Chipps Island**



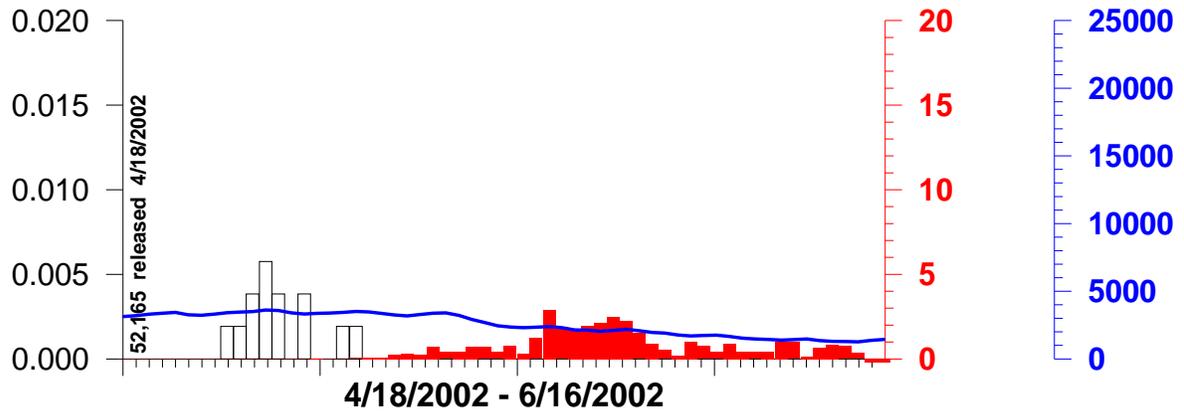
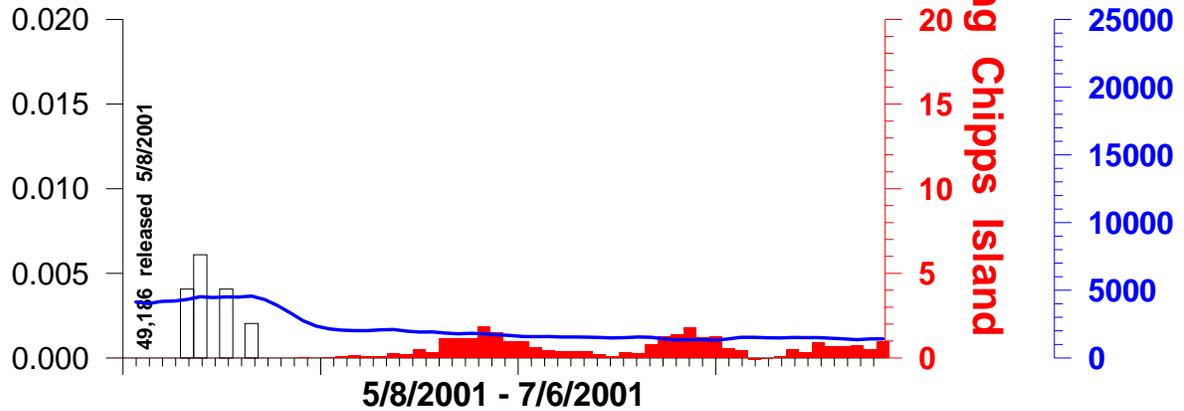
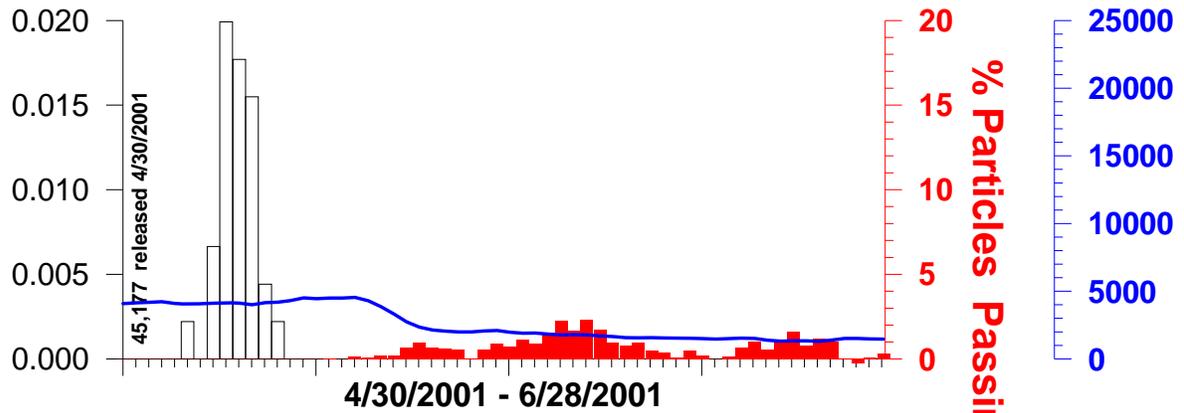
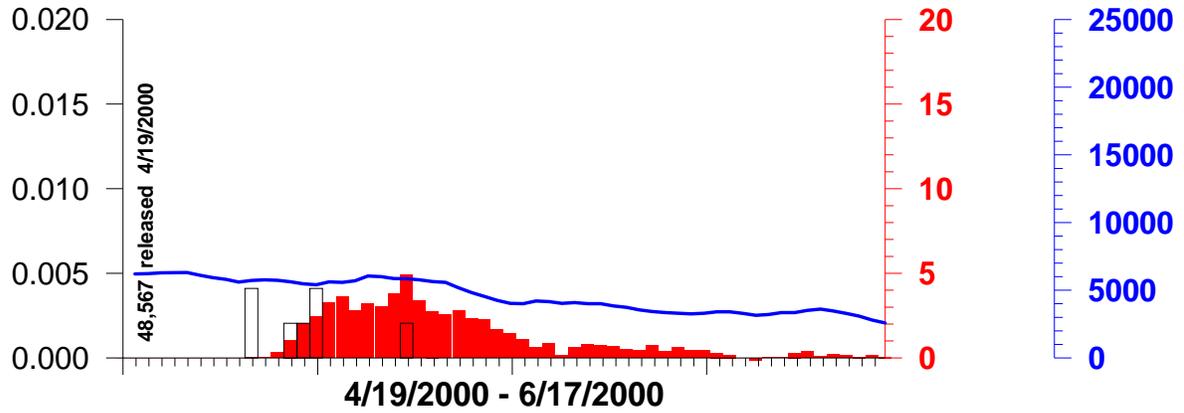
**% CWT Chinook Recovered at Chipps Island**



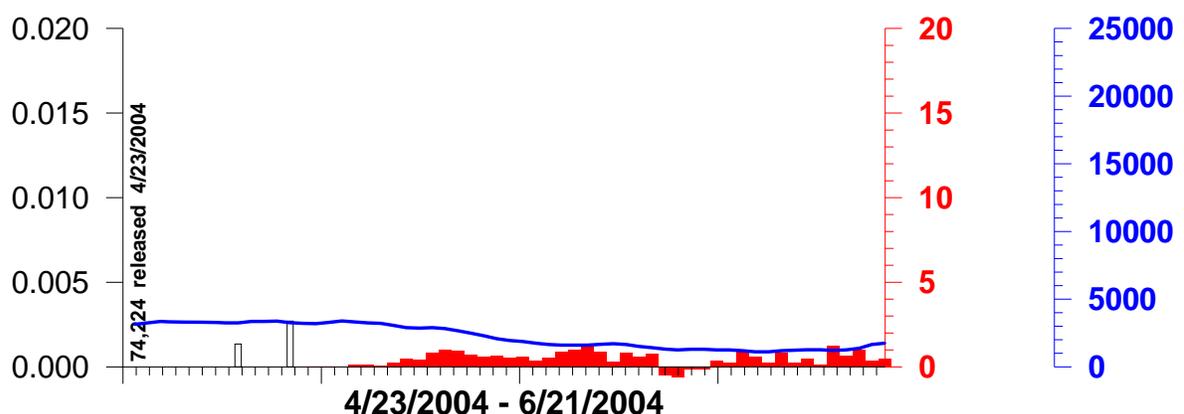
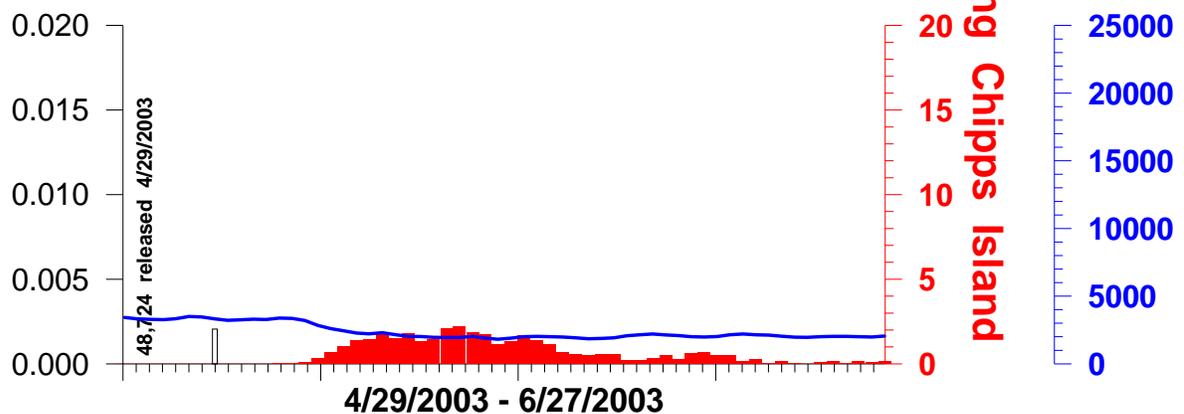
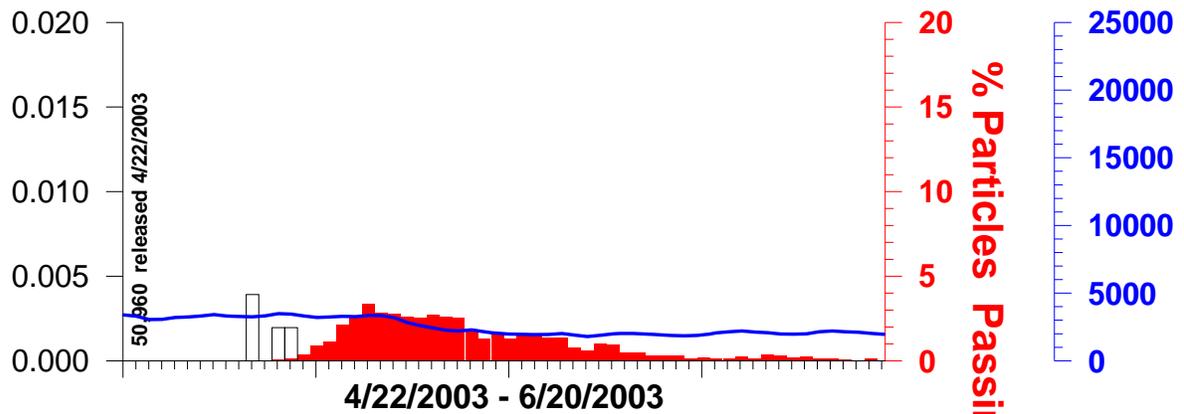
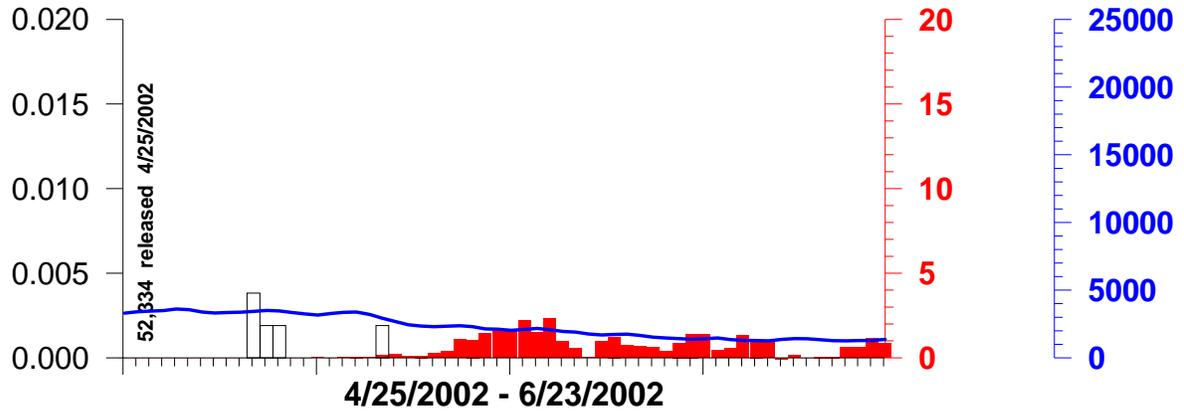
**% CWT Chinook Recovered at Chipps Island**



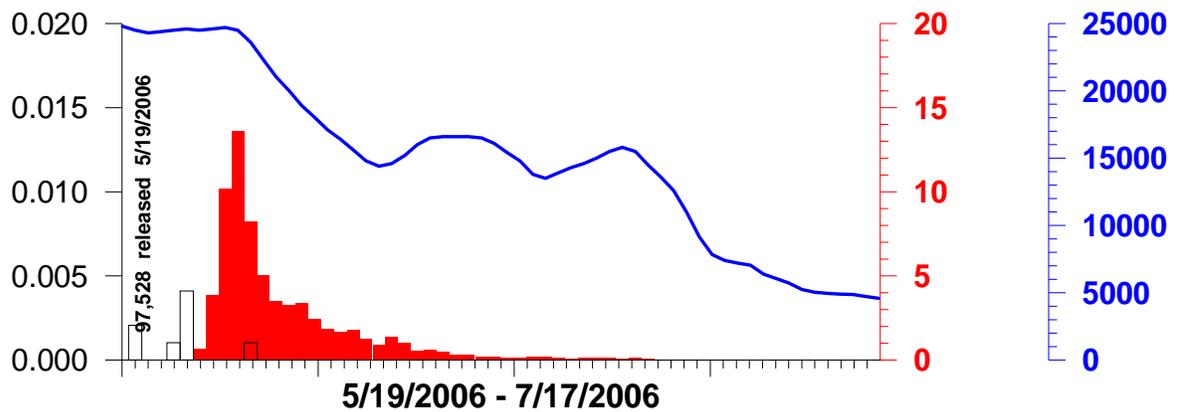
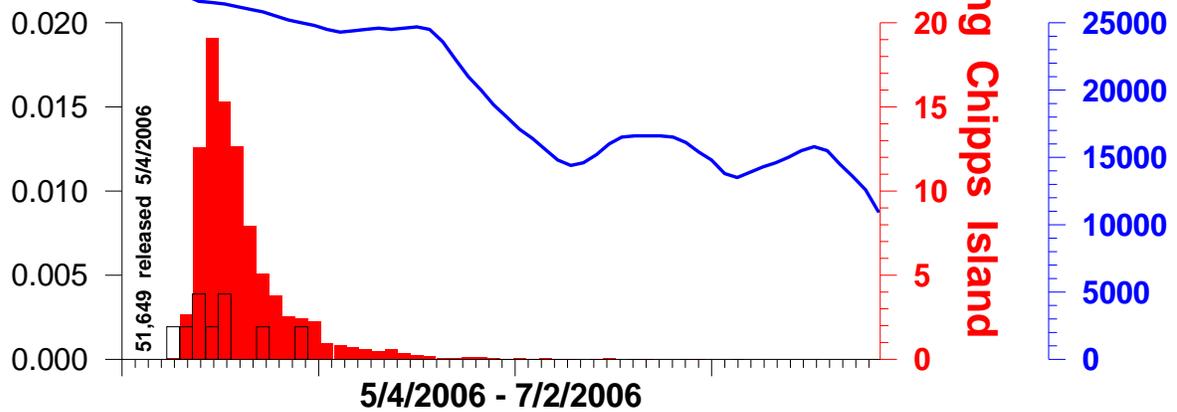
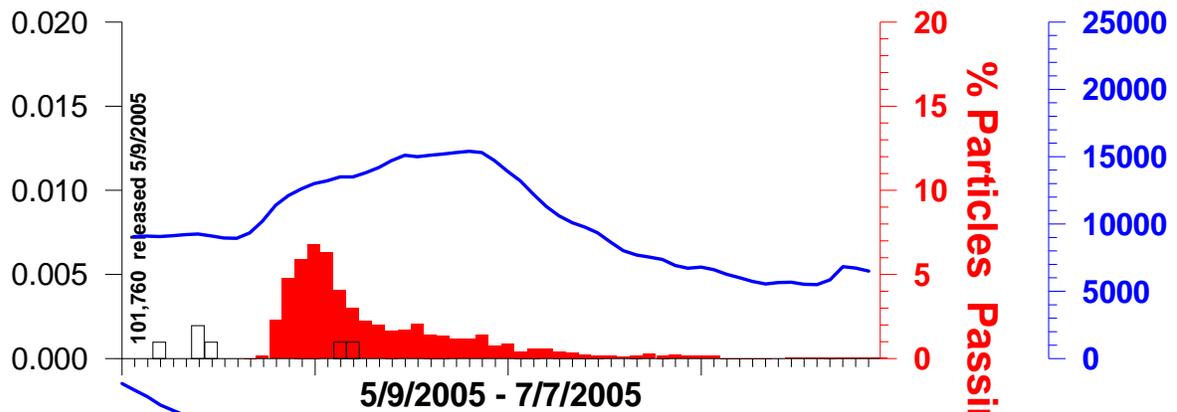
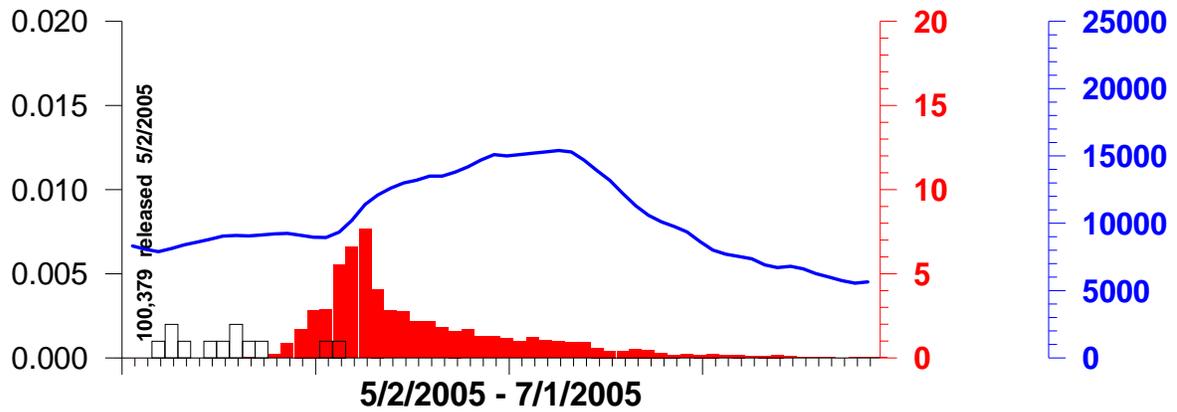
**% CWT Chinook Recovered at Chipps Island**

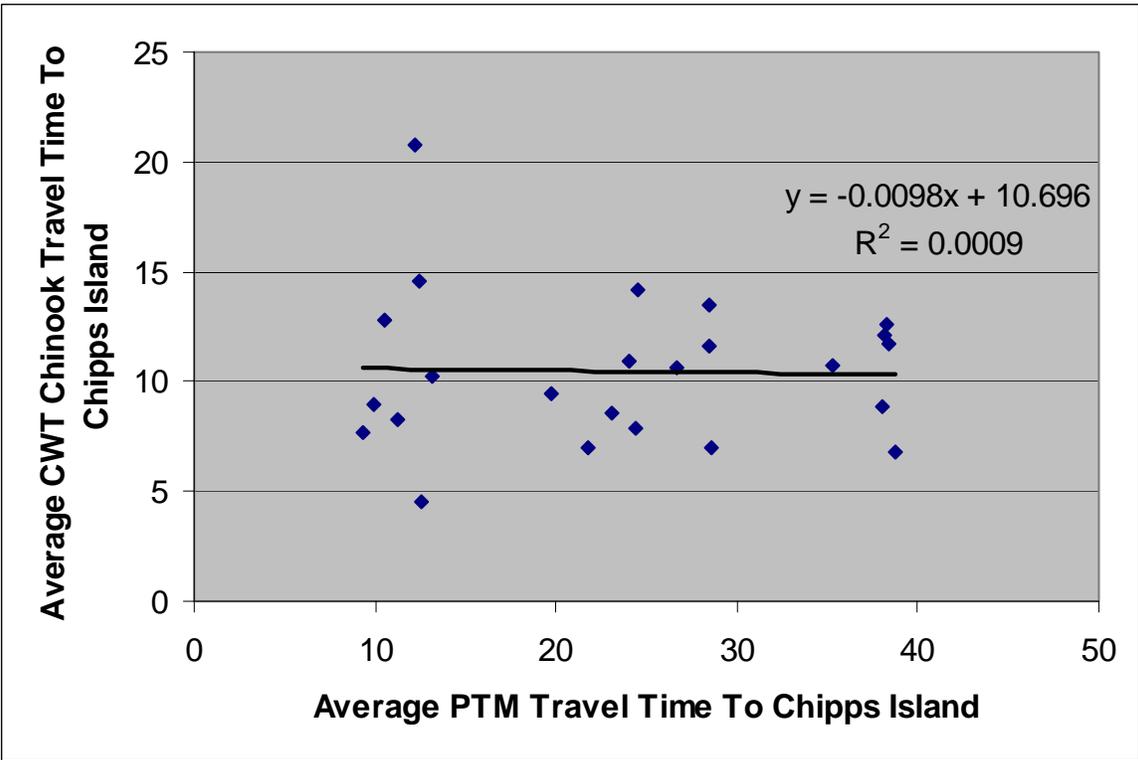
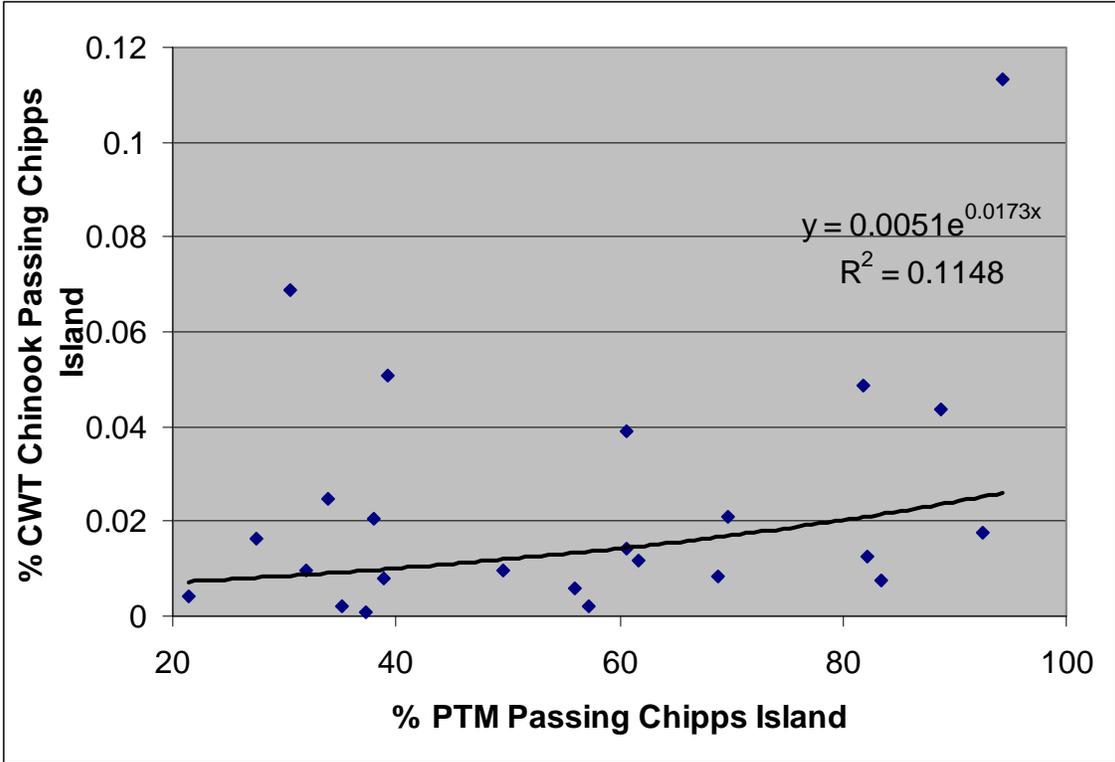


**% CWT Chinook Recovered at Chipps Island**



**% CWT Chinook Recovered at Chipps Island**





### Use of Data in the Implementation of the January 12, 2012, Joint Stipulation

The January 12, 2012, joint stipulation page 4, paragraph V says, “Real-time operations screening criteria will be developed based on hydrodynamics and particle Tracking Model (‘PTM’) runs, and other relevant available scientific information and considerations...” The following is the list of other information specified in the joint stipulation, and how NMFS and the technical memorandum planning/drafting committee used each in the development of the technical memorandum, and considered them through the Delta Operations for Salmonids and Sturgeon (DOSS) group, Water Operations Management Team (WOMT), and NOAA’s National Marine Fisheries Service (NMFS) determination processes:

- a. The fraction of particles that reach Chipps Island: NMFS’ March 16, 2012, technical memorandum (tech memo) specifically considers the fraction of particles that reach Chipps Island in its PTM screening criteria
- b. Particle residence time: The tech memo specified 28 days to allow particles to resolve their fates, but provided for an amendment if the fates of a significant number of particles are not resolved within 28 days. As part of the DOSS advice from April 3, 2012, DOSS advised WOMT and NMFS to amend the simulation period, to be determined by the number of days in which 50% of inserted particles have reached some fate in the scenario (either the baseline scenario or any of the three operational scenarios) with the slowest dynamics. By measuring particle fluxes on the same day after particle insertion for all scenarios, differences in particle residence times were captured by the PTM screening criterion specified in the tech memo.
- c. Results showing particle capture at various diversions in the delta: The tech memo specifically considers the fraction of particles that are captured at the Federal and State fish facilities. The PTM screening criterion did not include particle entrainment into the agricultural diversions or the diversions of the Contra Costa Water District. Entrainment into agricultural diversions was not considered because while particles enter agricultural diversions according to the flow split into agricultural diversions, we don’t expect fish to do so, given the small intake sizes. The depletion of particles by this possibly unrealistic fate does mean that fewer particles remain in the system to meet other, more realistic fates. This issue was discussed by NMFS and DWR during development of the PTM modeling request, but there was no readily available modeling option that would allow PTM to prevent particle uptake into agricultural diversions. This issue was noted again at the February 7th workshop, and is an issue that should be considered in ongoing efforts to refine the PTM model to capture salmonid behavior. Entrainment into the CCWD diversions was not considered since changes in OMR levels were expected to result from changes to CVP and SWP export levels (and associated entrainment).
- d. Relevant available information from:
  - a. *trawls and rotary screw trap (RST) information*: Most of these data were already considered to evaluate timing of steelhead entry into the Delta during April and May. A review of historical catch data suggest that steelhead enter the Delta from Mossdale, the Calaveras, and the Mokelumne throughout April and May. Given

the expected scarcity of San Joaquin basin steelhead, and the lower efficiency of trawls and RSTs to sample juvenile steelhead (compared to sampling for juvenile Chinook salmon), NMFS' preliminary conclusion was that these monitoring tools were not well suited to estimating the precise temporal onset and conclusion of migration in a specific year. At the February 7 workshop, NMFS presented that preliminary conclusion and asked if anyone felt that those monitoring tools had sufficient power to measure Delta entry on a finer temporal scale than "entering through April and May." No one spoke up to suggest that, for example, a steelhead observed in the Mossdale trawl on April 8<sup>th</sup> would indicate migration into the Delta but that no catch of steelhead in the Mossdale trawl on April 9<sup>th</sup> would indicate that migration had ended. One participant did suggest a temperature off-ramp; *i.e.*, to assume that the migration period is over once temperatures reach some level. While this option was discussed in the drafting of the tech memo, NMFS had concern over including a temperature off-ramp in May.

- b. *salvage*: The "Railroad Cut exposure trigger" described in the tech memo, to be implemented from mid-April through May, is designed to trip when the number of fish passing the acoustic receivers on Old and Middle rivers near Railroad Cut exceeds the number that would be expected to result in 2% loss of the release group at the fish collection facilities. While presumed loss (itself related to salvage) at the fish collection facilities is used to set the exposure trigger level, and a second trigger based on entry of acoustically-tagged fish into the fish collection facilities may be used if data are available during April-May 2012, salvage or loss of wild steelhead is not used for managing OMR flows during April and May 2012 for two reasons. First, steelhead from the San Joaquin Basin are scarce and absence in salvage may not indicate absence in the Delta. Second, it is not possible (under current practices at the fish collection facilities) to distinguish wild steelhead observed in salvage as originating from Sacramento or San Joaquin basin tributaries.
- c. *hydrodynamics*: The PTM approach used for the first two weeks of April depend on DSM2 Hydro runs based on forecasted hydrology.
- d. *empirical data from previous VAMP studies*: Empirical data from previous VAMP studies was used primarily in the assessment of the effects of the rock barrier. NMFS concluded that a rock barrier was likely to improve the survival of fish entering the Delta from upstream of the head of Old River. Most years of VAMP studies evaluated survival through two through-Delta routes – the mainstem San Joaquin River and Old River – and do not allow analysis of the possible effects of OMR management on route selection and survival in south delta channels. Acoustic tag data from the 2010 VAMP study did provide some survival estimates in more spatially resolved Delta reaches; one of these survival estimates was used in the calculation of the exposure trigger to be used mid-April through May. Because of intensive post-processing needs, the acoustic tag data from the 2011 VAMP experiment and six-year steelhead study are not yet available for analysis.
- e. *survival equations*: Survival equations based on Ken Newman's analysis of through-delta survival in the mainstem San Joaquin and Old River routes based on coded-wire tagged fish were used to evaluate the expected effects of the operation

of a rock barrier at the head of Old River. As mentioned previously, NMFS concluded that a rock barrier was likely to improve the survival of fish entering the Delta from upstream of the head of Old River.

- f. *modified Delta Passage Model (DPM)*: Cramer Fish Sciences is working on a modified DPM that captures south delta channel complexity (as acknowledged in the tech memo) but NMFS has not yet been provided any proposal for a “revised-DPM-based” approach to OMR management during April-May 2012. The existing DPM (being used in BDCP) includes junctions at the head of Old River and the Mokelumne and models through-delta survival only via two routes: the mainstem SJR and Old River routes. This version of DPM is not spatially explicit enough to evaluate hydrodynamic effects on the survival of Calaveras/Mokelumne steelhead during outmigration under different OMRs. DPM was also mentioned in the joint stipulation on page 5, line 17 as it pertains to the Delta Conditions Team (DCT), but the DCT has not, to date, provided any data or outputs utilizing the DPM.